REVISION DOCUMENTATION SHEET

Revision Number	Date	Describe Changes Required for Revision of Justification for 'No Evaluation' Required
1	1/25/96	The overall purpose of this revision to this USQD is to provide additional information and clarification Most of the additional information is added to the Compensatory Action question, which identifies plant programs that address issues associated with the General Vulnerabilities The scope, analysis, and conclusions of the USQD were not changed Revision bars identify the changes The revisions are on pages 2, 7, 18, 26-30, 33, 34

USQD TITLE: DEPARTMENT OF ENERGY, PLUTONIUM ES&H VULNERABILITY ASSESSMENT, ROCKY FLATS SITE ASSESSMENT TEAM REPORT, July 29, 1994

DESCRIPTION AND PURPOSE OF PROPOSED ACTIVITY:

This USQD evaluates the conditions in the Department of Energy, Plutonium ES&H Vulnerability Assessment, Rocky Flats Site Assessment Team Report, herein referred to as the Assessment. It is Nuclear Safety's opinion that this Unreviewed Safety Question Determination (USQD) is not the proper venue for concurrence of this Assessment. Nuclear Safety's review of this Assessment is not to support, validate, or substantiate the statements made in the assessment. The Assessment does not contain any approval authority nor validation by any organization Statements contained within the Assessment are not clearly supported. The purpose of this USQD is to determine if there are any new USQ issues identified in the Assessment. This is done by providing (1) a condensed description of the Assessment and an overview of the methodology used to perform the assessment, (2) a list of the overall conditions and general vulnerabilities described in the Assessment along with additional information to help characterize the general vulnerabilities, (3) a review of the postulated events with comments as to how the SAR analyzed that type of event, and (4) a summary discussion of the USQ potential of the general vulnerabilities and events As the Assessment is extensive and presents several issues, this USQD is rather long Table 1 provides a listing of the contents and page numbers It is suggested that the reader read the section that describes the overall conditions and general vulnerabilities before reading the summary description of the USQ potential of the general vulnerabilities

Table 1 USQD Sections and Assessment Topics

USQD Section	Page	Topic
Description of Proposed Activity	3	• A brief discussion of how the USQD process is used to evaluate the Assessment
	4	• An overall description of the Assessment
	4	• A synopsis of the assessment methodology used in the Assessment
Safety, Operating Function and Operating Condition Identification	8	• Overall conditions and general vulnerabilities described in the Assessment
Failure Mode, Hazard and Accident Identification	15	• A review of the postulated events
USQD Questions	25	• A summary discussion of the USQ potential of the general vulnerabilities and events

USQD Application

For this USQD the proposed activity is the continuation of activities in light of those conditions described in the Assessment. The 'as found' conditions are viewed as proposed activities that may change the facility as is explicitly or implicitly described or assumed in the various Final or Draft Safety Analysis Reports Some of the conditions (i e , vulnerabilities) in the Assessment have been identified as USQs in previous USQDs These issues may be discussed within the USQD for completeness This USQD does not evaluate any proposed corrective actions described within the Assessment. These will be evaluated during their planning and implementation processes Due to the qualitative nature of the Assessment, the USQD questions must be answered in a like fashion For reasons presented in the USQD question section, the USQD questions are only applied to the six general vulnerabilities, not to the postulated events

Overall Description of Assessment
The Assessment assesses environmental, safety and health (ES&H) vulnerabilities resulting from the storage and handling of plutonium in Buildings 371, 559, 707, 771, 776/777, 779, and 991 The term "ES&H Vulnerability" means any condition, other than diversion of material (i e sabotage), that could lead to unnecessary or increased exposure of workers and the public to radiation or to the release of radioactive materials to the environment. The Assessment was performed in accordance with a methodology provided by the Secretary of Energy The Site Assessment Team was composed of representatives from numerous groups Team membership is shown in the Table 2

Table 2 Site Assessment Team Membership

Name	Contributed to	Name	Contributed to
S.L Browdy	Core	P F Ervin	Core
A C Stalker	Core	P A Burdeaux	Core
S H Davies	Core	R.L Moore	Core
L D Danio	Core/707	J A Geis	779
R J Ballenger	779	R J Schmidt	779/559
K A Sarafin	779	F G Hudson	779
K P Ferrera	779	S L Wilson	991
A R Harper	991	R J Sironen	559
J W Goggin	776/777	A A Dye	776/777
W B Fleming	776/777	M.R Coubrough	776/777
D F Dustin	776/777	A.J. Holifield	707
G M Trieste	707	B D Larsen	771
R A. Falter	371/771	J.P Moore	All seismic
B G Cambell	All fire	C.J Freiboth	707
S L Yela	559, 707, 779, 991	R W Blair	371
E Kray	371	A J Hazel	371

The team evaluated inventory data with respect to location of plutonium, its associated packaging, and age of that packaging The inventory includes Special Nuclear Material (SNM), residues, wastes, process hold-up and sources Waste is excluded from the assessment except in cases where plutonium waste are co-located in the same buildings as inventoried material Each building is assessed to determine the building release paths Release paths are from 1) vaults, 2) gloveboxes in rooms, or 3) material in rooms or halls Packaging configurations are evaluated against these groupings Various adverse conditions are assessed for each building From the adverse conditions accident events are postulated Ten different types of events are depicted

The Assessment identifies individual vulnerabilities or events as well as six general vulnerabilities In order to provide as clear assessment as possible a synopsis of the Assessment's methodology is included with annotation regarding differences between the FSAR and Assessment methodologies Unfortunately, this makes a rather extensive and long determination A brief description of the overall methodology is below. The vulnerabilities are described in the Safety, Operating Function, and Operating Conditions Identification section of this USQD

<u>Assessment Methodology</u>

The Assessment is comprised of a fairly small body which summarizes individual building assessments located in the appendices The assessments are qualitative The Assessment does not present sufficient detail to allow for an independent review The following describes the overall assessment process that is used for each of the buildings

- A summary description of the facility is provided, including a description of processes, operations and storage

- Holdings within the buildings are characterized, identifying the types of plutonium (e g , weapons grade, sludge or salts), and packaging types and combinations thereof (e g , plastic bagging, cans, vessels, plastic containers drums) Quantities or proportion of material in each type of containers is not given in the Assessment

- Different types of physical barriers are identified A description of the barrier is provided, however, a measure of their effectiveness under accident conditions is not characterized

- Actual or potential adverse conditions under which the plutonium is stored or handled are identified The types of adverse conditions include aging, pressurization, pyrophoricity, radiolysis, equipment failure, change in mission, and administrative controls Indications of the magnitude of the problems is provided through the use of Occurrence Report statistics Table 9 (in the Safety, Operating Function and Conditions section) presents a summary of these statistics

- Historical, current or potential events that have or may result from the adverse conditions are identified These are 1) leakage/spill, 2) breach of container, 3) material fire, 4) loss of confinement, 5) criticality, 6) external exposure, 7) explosion, 8) facility fire, 9) earthquake, and 10) aircraft crash Only the radiological consequences from these events are estimated in the Assessment The magnitudes of the individual events are not listed in the Assessment

- Compensatory measures at the facility that prevent and/or mitigate the adverse conditions and events are identified These measures include Conduct of Operations, Configuration Control of Design, Emergency Management, Safety Systems, and Alarm Systems Compensatory measures provide partial mitigation of the adverse conditions and events by reducing the probability that an adverse condition will propagate to its resultant event The degree of mitigation is not estimated in the Assessment

- From the identified events and taking into account compensatory measures, potential vulnerabilities (i e , consequences) to the worker, environment, or public are identified Identification of a vulnerability consists of either a positive or negative response concerning the potential for contamination, exposure, or injury from various types of events (e g , spill, loss of confinement, fire, or explosion) An example is described in Table 3

Table 3 Example of Vulnerability Existence Matrix - Worker

Event	Contamination	Exposure	Injury
Leakage/Spills	Y	Y	Y
Personnel External Exposure	Y	Y	N
Fissile Material Release	N	N	N

- An affirmative indication requires a short description of the scenario Within this description the likelihood and magnitude of the consequence is estimated to be either low, medium, or high Paraphrased from conversations with team members the following tables present the definitions of low, medium or high The Assessment included the timing of proposed corrective actions The timing is grouped into immediate, near term, and long term concerns These are defined in the tables

Table 4 Definition of Likelihood Parameters

Parameter	Definition
Low	Event is not likely to occur within the next 5 years, but is likely to occur within the expected life of the facility This includes less likely events such as earthquakes
Medium	Event is not likely to occur immediately, but is likely to occur in 2 to 5 year time frame
High	Condition currently exists or event is likely to occur within two years

Table 5 Definition of Worker Safety Parameters

Parameter	Definition
Low	Reportable injury, exposure above annual administrative limit for routine operations (i e , 1 0 rem CEDE)
Medium	Exposure above highest annual regulatory limits for routine operations (i e , ≤ 50 rem CEDE)
High	Death, disability, exposure or contamination limits leading to potential short-term radiological health effects (i e , > 50 rem CEDE)

Table 6 Definition of Public Safety Parameters

Parameter	Definition
Low	Exposure does not exceed limits but may require notification (i e , < 100 mrem CEDE)
Medium	Exposure above highest annual regulatory limits for routine operations (i e , ≥ 100 mrem < 1 rem CEDE)
High	Exposure above off-site emergency response levels (i e , ≥ 1 rem CEDE)

Table 7 Definition of Corrective Action Timing

Term	Definition
Long	Issues which are being mitigated by barriers and compensatory measures
Near	Issues that may become an imminent hazard with further degradation
Immediate	Issues that may present imminent safety hazards or concerns

REFERENCE DOCUMENTS

Final Safety Analysis Report - Building 371, and associated Operational Safety Requirements

Final Safety Analysis Report - Building 559, and associated Operational Safety Requirements

Final Safety Analysis Report - Building 707, and associated Operational Safety Requirements

Final Safety Analysis Report - Building 771, and associated Operational Safety Requirements

Final Safety Analysis Report - Building 776/777, and associated Operational Safety Requirements

Final Safety Analysis Report - Building 779, and associated Operational Safety Requirements

Draft Safety Analysis Report - Building 991, and associated Operational Safety Requirements

OTHER REFERENCES

- USQD-707-94-0375-SDK, Building 707 Implementation Plan for Compliance With HSP-31 11, Rev 2, January 26, 1994
- USQD-RFP-93 1170-TLF, Plutonium Storage Issues Including HSP/FLP 31 11, September 3, 1993
- USQD-RFP-94 0084-TLF, Transfer and Storage of Plutonium for Fire Safety, November 2, 1993

- USQD RFP-94 0615-ARS Rev 1, Non-Resumption Plutonium Building HEPA Filter Plenum Testing at Rocky Flats Plant Zones I IA, and II, Rev 1, August 1994
- Management Plan for Resolution of the Safety Issues Associated With the Storage of Plutonium, Rev 3 November 8, 1993
- Health & Safety Practices Manual 1-82500-HSP-31 11, Transfer and Storage of Pyrophoric Plutonium for Fire Safety, Rev 0, November 5, 1993
- 3-J69-NSPM-5C-01, Rev 0, Nuclear Safety Procedures Manual Evaluation of Unreviewed Safety Questions, September 12, 1994
- Shift and Standing Orders Manual, Standing Order No 21, ' Special Nuclear Material (SNM) Handling Restriction," May 4, 1993
- USQD 707-94 1523-WGH, Impact of DOP Testing Only 2-Stages of the 4-Stage Zone I/IA HEPA Filters in Building 707, September 1, 1994
- Safety Assessment of Plutonium in Storage Tanks and Related Issues at the Rocky Flats Plant, LA-CP-91-44, February 1991
- Plutonium and Uranium Solutions Safety Study, LA-UR-93-3282, October 1993
- Draft USQD-RFP-95 0387-CAS, Gaseous Hydrogen Generation and Accumulation in Solution Tanks in Buildings 371 and 771, March 30 1995 (still in review)
- Human Factors Review of Compensatory Measures, JWK-003-95
- Non Destructive Assay (NDA) Measurements of Process Holdup, July 1990
- USQD 559-91 0007-JRW, Material Hold-up in Bldg 559, February 1991
- USQD-707-91 0068-JRW, Material Hold-up in the Ducts Bldg 707, July 1991
- USQD-771-94 1592-BJS, Safety Analysis of Material Hold-up in Ductwork, September 1994
- Rocky Flats Plant Transportation Safety Manual
- Site Integrated Stabilization Management Plan, October 10, 1995
- Implementation Plan for Recommendation 94-3, Rocky Flats Seismic and Systems Safety, June 1995
- Standing Order Number 39, *Management of Bottled Actinide Solutions,* June 5, 1995
- Building 886 Basis for Interim Operation, Revision 1, October 1995

APPLICABLE REQUIREMENTS

DOE Order	Description
5480 7A	Fire Protection
5480 21	Unreviewed Safety Questions
5480 23	Nuclear Safety Analysis Reports

SAFETY, OPERATING FUNCTION, AND OPERATING CONDITIONS IDENTIFICATION

This section normally describes the applicable normal, abnormal, and emergency functions and operation conditions for equipment directly and indirectly affected by the proposed activity Described in this section are the overall conditions and general vulnerabilities described in the Assessment As defined in the Assessment these conditions contribute to unnecessary or increased exposure to radiation to workers and the public or to the release of radioactive materials to the environment They are, on very broad terms, conditions of 1) the MAR, 2) the equipment used to contain and confine the MAR, 3) equipment used to mitigate the consequences of postulated accidents, and 4) administrative controls (i e , procedures and OSRs) to ensure safe operation and maintenance of this equipment Thus, this is all inclusive In the following, the general vulnerabilities are listed with supplemental information that characterizes the vulnerability Also presented are the programs that address the vulnerability and whether the vulnerability has been addressed in a previous USQD

Overall Conditions and General Vulnerabilities

The Assessment also indicates design life position of the facility and equipment This is based on facility design life and age of the building However, some of the equipment has been replaced or upgraded Table 8 shows the design life position of each building as indicated in the Assessment

Table 8 Position in Design Life of Facility and Equipment

Building	Position
371	Middle
559	At or exceeded
707	At or exceeded
771	At or exceeded
776/777	At or exceeded
779	At or exceeded
991	At or exceeded

Largely, the Assessment used Occurrence Report Statistics to provide an indication of the current status of equipment failure and the root causes A summary of the statistics is provided in Table 9

Table 9 Occurrence Report Statistics

Building	Number of Reviewed Occurrence Report	Equipment Failure		Inadequate Preventive Maint		Not Completed Work on VSS	Reduced Levels of Experience		Inadequate Config Knowledge		Administ Controls	
		No	%	No	%		No	%	No	%	No	%
371	332	145	44	2	1	33/99	55	17	16	5	16	5
559	331	78	24	2	1	26/90	103	31	33	10	39	12
707	699	246	35	4	1	49/140	210	30	31	4	57	8
771	331	103	31	NL		57/109	80	24	NL		20	6
776/777	306	117	38	NL		24/56	86	28	13	4	17	6
779	127	26	20	2	2	18/39	32	25	10	8	22	17
991	74	32	43	1	1	9/11	23	31	NL		14	19

NL - Not Listed

The Assessment identifies six general vulnerabilities, that are discussed below As indicated by the Assessment, these vulnerabilities, if left unmitigated, have the largest potential consequences The Assessment provides the following statements

> "The most important vulnerability on a frequency basis is that liquids containing plutonium are stored in containers that are being attacked by the solutions These containers are presently failing on a random basis "

> "The most important vulnerability on a material-at-risk basis is that solid plutonium is packaged for short-term storage These conditions are presently degrading the containers, potentially to failure, which allows release of the material in the building "

General Vulnerabilities

GV # 1 Plutonium solutions have been stored for five years in plastic bottles, system piping and tankage not designed for this length of storage These confinement systems are degrading with the passage of time

Though several programs are addressing this condition and SESs/USQDs have evaluated parts of the program the condition of storing plutonium bearing acidic and basic solutions in containers not designed for extended storage has not been evaluated with the SES/USQD process The DOE RFFO twice contracted the Los Alamos Technology Office to study this issue Their findings are in LA-CP-91-44 *Safety Assessment of Plutonium in Storage Tanks and Related Issues at the Rocky Flats Plant*, February, 1991, and LA-UR-93-3282, *Plutonium and Uranium Solutions Safety Study*, October, 1993

The LA-CP-91-44 study found no apparent imminent criticality safety concerns, but it concluded that it is unwise to allow the condition to continue indefinitely 'The risk of complications will increase significantly because of deterioration of equipment and chemicals if the resins and hydrogen peroxide are not stabilized before resumption' (p 1) 'In brief, the concerns about anion exchange resin, annular tank calculations and inspection reports, and hydrogen peroxide solutions should be addressed quickly, on a time scale of a few months, without waiting for full resumption of B771 Beyond these concerns, the situation for ring filled tanks, other types of tanks, americium in-growth, and plutonium solutions in plastic bottles (if inspected in the meantime) is stable enough to await resumption of B771, if the resumption occurs in about a year, as is currently planned' (p 1)

The LA-UR-93-3282 study examines many of the same conditions that the 1991 study examined but in light of near- and long-term storage The 1993 study found, ' (the) principal hazard of concern is spills or leaks of radioactive solution The probability of spills and leaks will increase as the containers age' (p, iii) The report sites that B771 recorded 14 radioactive leaks from 8/91 to 7/93 This is about 8 spills a year The study found the predominant source of leaks are gasket, joint and valve failure and pitting corrosion The study did not quantify the size of the spills 'LANL personnel concluded that long-term storage of plutonium in tanks that were not designed for that purpose had the potential to create serious safety hazards' (p 5) 'This situation was unprecedented, and no organized database existed from which to predict the long term stability of the solutions and resins' (p 1)

'Pitting corrosion occurs when tanks contain materials that attack the stainless steel' (p 5) 'Fluorides and chlorides attack stainless steel, although nitric acid (if present) will inhibit corrosion by passivating the surface The tanks that are used primarily for storing hydrochloric acid are lined However, B771 personnel report that some of the tanks used to store other materials (e g , glovebox cleanup waste, ash effluent, and the B771 parts-cleaning solutions with higher levels of uranium) are not lined, and process knowledge indicates that these tanks may contain chlorides and fluorides that could attack the stainless steel' (p 6) This study indicates that nitric acid is not especially corrosive on 304 L stainless steel at room temperature, referencing a corrosion rate of 0 0006 in per year for red fuming nitric acid from *A Guide to Corrosion Resistance* (1961) However, analysis of nitric acid that had been in the tank for one year at LANL found slight leaching of stainless steel

The following summarizes a telephone conversation with Larry Peppers of Material Surface Technology at REFTS Nitric acid is generally very compatible with stainless steel However, corrosion problems existed before the 1989 shutdown and have increased since the shut down The problems are largely related to localized corrosion That is, generalized corrosion of tanks has not been experienced Corrosion problems have existed on a few lines Stagnant conditions enhances local corrosion as compared to flowing conditions Local corrosion occurs at crevices and places where debris or salts may buildup (e g , flanges and welds in pipes and tank appendages) This is generally referred to as pitting corrosion Generally, pitting corrosion causes small leaks not catastrophic failure Catastrophic failure is caused by stress corrosion, as experienced in the hydrofluoric acid line

Leaving the solution in the tanks may also lead to stratification of the plutonium solution and radiolysis of the water molecules in the solutions Criticality Safety has reviewed conditions that could lead to stratification with the current status of the tanks These conditions are high plutonium content, low concentrations of nitric acid (less than 1 Normal), and the presence of organics Based on current information none of the tanks present these conditions Radiolysis and accumulation of hydrogen in the tanks is evaluated in USQD-RFP-95 0387-CAS, *Gaseous Hydrogen Generation and Accumulation in Solution Tanks in Buildings 371 and 771* This USQD resulted in a positive USQ condition This is based on creating an accident of a different type than any previously evaluated in Safety Analyses The USQD did not require any ompensatory measures The conclusion is as follows

'Several of the existing tanks in Building 771 and 371 have the capability to accumulate radiolytic hydrogen to the extent that this hydrogen would represent a significant hazard All of the susceptible tanks in Building 771 however have been demonstrated to be vented, and the rates of hydrogen production in the susceptible Building 371 tanks is such that these tanks can remain un-vented for an additional two (2) years from the time of this writing prior to these tanks representing a concern that will require re-evaluation (The 371 tanks are capable of accumulating hydrogen to pressures only slightly in excess of atmospheric pressure and the accumulated hydrogen inventories could, at worst, result in deflagrations outside the ruptured tanks with TNT equivalence of less than 20 g)

Venting of susceptible tanks has been verified Therefore the extent of any ignition of hydrogen would be limited to deflagrations outside tanks ruptured by detonation The risk from this hazard is bounded by the existing Safety Analyses as defined in 3-J69-NSPM-5C-01, *Evaluation of Unreviewed Safety Questions* However, since this hazard has not been analyzed in the existing Authorization Basis and represents an undefined workers safety hazard, it does constitute an Unreviewed Safety Question (USQ) '

This vulnerability is being addressed in various stabilization programs for the buildings identified as containing stored solutions Unfortunately, these programs have yet to be fully implemented The activities within these programs will be accomplished using Task Information Packages (TIPS) or other established programs (e g , Integrated Work Control Package Program) that will be fully evaluated using Safety Evaluation Screens (SES) or USQDs as required These stabilization programs will alleviate identified processes related to safety concerns and place applicable buildings in a safe condition to await decisions regarding final disposition

GV # 2 Plutonium is known to be stored in contact with plastic or other organic material and oxidation of metal is occurring Both conditions challenge container integrity and increase the fire hazards of the storage configurations

Procedure HSP-31 11, "Transfer and Storage of Plutonium for Fire Safety," Rev 0, defines the interim responsibilities and requirements for packaging, transferring, and storing plutonium, Pu oxides, and Pu compounds to minimize the possibility of Pu fires until long term transfer and storage requirements are determined This procedure is evaluated in USQD-RFP-94 0084-TLF This evaluation concluded that storing plutonium, as stated in the procedure, the risk of an accident would not increase This procedure specifies requirements to ensure the fire safety of plutonium and no special compensatory actions are required other than certain safety systems be operable

A *Management Plan for Resolution of the Safety Issues Associated with the Storage of Plutonium*, July 8, 1993 has been published This plan includes the scope of inspecting and repackaging, as necessary, any packaging configuration deemed unsatisfactory

USQD-RFP-93 1170-TLF evaluated the existing condition of the storage of potentially pyrophoric plutonium as it has been from the curtailment of production operations in December 1989 to the date of the USQD This evaluation also assesses the failure to comply with the requirements of HSP/FLP-31 11 as described in Occurrence Report RFO-EGGR-SITEWIDE-1993-0002 and the continuing increase in the quantity of dispersible plutonium oxides present at Rocky Flats Environmental Technology Site The evaluation concluded that an Unreviewed Safety Question existed As a result of this conclusion, compensatory measures were developed which included, Standing Order No 21, May 4, 1993 restricting the handling of potentially pyrophoric plutonium, and implementation of corrective actions addressed in the *Management Plan for Resolution of the Safety Issues Associated with the Storage of Plutonium*

GV # 3 Degradation of Vital Safety Systems (VSS) concurrent with the loss of experienced plutonium handlers lengthens both the "hands-on" duration of an activity and the calendar time to complete the activity Both conditions increase the radiation exposure of the material handlers and their support personnel

This general vulnerability has not been previously evaluated with the SES/USQD process This vulnerability addresses ALARA concerns but it has implications on the reliability of VSSs The Assessment provides occurrence report statistics related to equipment failure and personnel error The statistics range from 1990 to approximately May 1994 The percentage of occurrence reports that can be contributed to equipment failures ranges from 20 to 44 percent for the different buildings The percentages contributed to personnel error range from 17 to 31 percent

Vital Safety Systems deficiencies must be repaired, or have compensatory measures in place prior to personnel performing operations Maintenance of VSS is prioritized For example since exhaust fans pull air through the HEPA filters, therefore they have a higher priority than supply fans However, maintenance (preventive and corrective) practices have changed since the FSAR was written The changes have increased the repair time for corrective maintenance, and budgetary changes have impacts on the availability of personnel to conduct repairs and whether some 'non-essential' equipment is repaired As discussed below these factors resulted in many compensatory measures

The Assessment identifies maintenance deficiencies as a contributing adverse condition 'Equipment failures predominately result from age of equipment and lack of preventive maintenance Equipment failure degrades safety system performance Equipment age adversely affect performance due to the general inability to obtain replacement parts and reduced operational reliability The equipment failure rate has been increasing in recent years The lack of a rigorous preventive maintenance program contributes to the time dependent physical degradation of equipment ' (p B2-559-13)

As presented in Table 8 almost all of the buildings have exceeded their design life Operating equipment past its design life and preventive maintenance less than recommended by manufactures increases component wear out, increasing the failure rate Though some of the systems have been upgraded, some equipment is very out dated However, it is not unusual to have difficulty in getting replacement parts For example, the UPS system in Building 779 is reportedly more than ten generations behind the current model The vendor no longer carries documentation on the system

Several data bases were searched to explore the extent of increasing failure rates They are Occurrence Reports (ORs), Limit Conditions of Operation Tracking (LCOT), and Maintenance Work Control Forms (MWCFs) Histograms of the ORs from 1990 to 1994 do not indicate any overall trend These histograms are in Attachment 2 LCOT data lists when a particular LCO is not met, however, the data does not identify a particular system or component that is causing the out-of-tolerance condition Therefore, this data is not useful to this end Histograms of MWCFs submitted by Building 707 and Building 771 are also include in Attachment 2 Several outside influencing factors are evident in the histogram for Building 707 MWCFs These are mission change, resumption, and the decision to reduce the area within the building in which material is stored An increasing trend is not identified in these histograms

Though an increasing trend in failure rate is not identified, a review of the MWCFs provide indications that some components are not operable requiring some type of compensatory measures This is an indication that the system's functionality is not what it was originally assumed The compensatory measure may be operating the component in a manual mode rather than automatic, or it may require some action such as fire watches Examples of system degradation are provide below

- Building 371
  - Instrument Air is inoperable
  - Compensatory measures are established for inoperable portions of the LS/DW
  - Zone I Systems - 2 of 5 systems have only one operating fan, 1 system has a bad bearing on a fan
  - Zone II or Zone III Exhaust Fans - 7 of 10 fans have problems 4 fans have bearing, vibration or knocking problems 1 will not start 1 will not start on emergency power 1 is inoperable with indicator showing operable
  - Zone II Supply Fans - 1 of 6 fans has been down for 4-5 years 1 fan does not have power

- Building 707
  - Supply fans - 6 of 13 supply fans are out with an additional 3 as questionable
  - Zone I Exhaust - There are 7 Zone I Exhaust Systems 1 System both fans are out It serves module D&E gloveboxes 1 System a single fan is out It serves modules F, G & H hoods
  - Zone II Exhaust - 1 of 9 systems has both fans out, 1 of 9 has no redundant fan, 3/9 systems have a single fan that is questionable These three systems serve modules A, B, C, and D

- Building 771
  - Fan interlock controllers - some may not operate as described in the FSAR
  - Power Supply - Recently performed work still requires 'hot' system operability testing, system operating procedures, and labeling
  - Fans -
    - Due to vibration problems the fans must operate at reduced speed High speed fan operation is used to help flush a room upon release of material The fans should not be operated at high speeds for longer than 15 to 30 minutes This was routinely done in the past
    - Shafts - In 1980 the original shafts in the supply fans were replaced All of these were replaced again this year

Component failure and system degradation is partially compensated for by Compensatory Measures JWK-003-95, Attachment 3, presents an assessment of the compensatory measures in Building 707 The conclusions from this attachment is follows

'Many of the compensatory measures are put in place to augment an automatic system that is not functioning adequately This review of compensatory measures has noted several areas where humans are less reliable than the mechanical system they are meant to support Humans are slower than mechanical systems, human reliability is lowered by stress, and other concerns may take priority over compensatory measures

It is difficult to address the issue of whether or not the ability to implement compensatory measures is being affected by the perceived loss of experienced personnel Many of the personnel who are responsible for compensatory measure, such as shift managers, [Shift Technical Advisor] STA, and [Stationary Operating Engineer] SOEs, are required to complete extensive training programs If the required training and sufficient staffing levels are sustained, then lack of experience should not affect the implementation of compensatory measures

The current system for managing compensatory measures relies heavy on the memories of a small group of individuals, however the effectiveness of human memory decreases as the number of items that must be remembered increases Twenty-seven (27) shift orders with compensatory measures spread through a total of over fifty (50) orders are impossible to memorize effectively and can be very time consuming and error prone to search through In addition, the high turnover rate of compensatory measures increases the probability of errors while updating the shift orders and status boards While this system may be able to handle a small number of compensatory measures there are currently too many for it to manage effectively '

The MWCF completion times are reviewed for insight into repair time Average completion times from the VSS MWCFs are rather long These are shown in Table 10 Included in the MWCF completion time is the period to close-out a work package, a low priority task MWCF completion time is not useful for estimating down or repair times, however, Building 707 Utilities Manager Bob Slaybaugh and former Building 771 Utilities Manger Joe Qualye estimate the repair time for two types of fan failures, belt and bearing failures These are shown Table 11 along with the values used in the FSAR Fault Tree Analyses

Table 10 Average VSS MWCF Completion Times

Component	Building 707	Building 771
All VSS	160 days	315 days
Belts	84 days	282 days
Bearings	27 days	766 days*

* This datum has little supporting data

Table 11 Zone II HVAC Repair Times

Component	Repair Times		
	B707 FSAR	B707	B 771
Bearings	2 hr	4 days	21 days
Belts	1 hr	20 hr	14 days

The increased repair time is attributed to availability of various personnel, lack of spare parts and implementation of the structured Integrated Work Control Process (IWCP) Limited personnel enforces coordination amongst maintenance, trade, and Radiological Control Technician personnel Timely coordination is not always possible due to training and other factors An inventory of spare parts used to be maintained One reason why Building 707 estimates for these repair times is significantly less than Building 771 is because Building 707 has acquired a minimum amount of replacement parts for these repairs The IWCP establishes a structured process for corrective maintenance and modifications This has increased the amount of time required to perform corrective maintenance The influencing factors on repair time apply to all maintenance, increasing the unavailability of components and systems

Repair times for two types of failures for fans are quantified This data indicates the component and system unavailability has increased by factors of one to several orders of magnitude Though the increased repair time is not quantified for other systems and components, the factors discussed above have implications for repair of other components and systems The risk significance of the increase is discussed later in this USQD

GV # 4 The material inventory differences (duct hold-up, waste shipments, assay errors) and their locations (relative to HEPA filters) potentially increase the consequences of any postulated event by an estimated 20-25 percent

Examples of material inventory differences include

- plutonium hold-up in the ductwork and gloveboxes,
- due to increasingly more accurate measuring devices and statistical variations of measuring the amount of plutonium in waste drums,
- contamination imbedded in the painted walls and floors

Inventory differences and fluctuations in Material-At-Risk are recognized and allowed for in the FSARs This is done in part by calculating best estimate MAR values and estimating a residence time factor for certain operations However, the increased inventory is not an increased MAR for any and all accidents For example the MAR for spills, loss of confinement or small/medium fires is not impacted This is because accidents such as these have less uncontrolled energy associated with them, allowing them to be better defined Other initiating events or accident scenarios that may involve large portions of the facility might involve some of this increased inventory The most significant inventory differences are those associated with plutonium hold-up in ductwork and gloveboxes

Several studies and USQDs have been performed evaluating the duct hold-up One of the initial studies is *Nondestructive Assay (NDA) Measurements of Process Holdup*, July 1990 Table 12 lists holdup summary for several buildings These values are based on initial measuring techniques and a statistical sampling plan and did not include holdup material in gloveboxes Additional estimates, for some buildings, have since been performed that included glovebox holdup The values in Table 12 are presented to help characterize the magnitude of the holdup

Table 12 Phase I Holdup Summary By Building

Building	Holdup (kg)
371	0 85
707	27 1
771	33 1
776	4 2
779	1 5

A USQD has been or is in the process of being performed for Buildings 371, 559, 707, and 771 These are

- USQD 559-91 0007-JRW, *Material Holdup in Bldg 559 Ducts*
- USQD 707-91 0068-JRW, *Material Holdup in the ducts Bldg 707*
- USQD-771-94 1592-BJS, *Safety Analysis of Material Holdup in Ductwork* (This is the only positive USQ)

Taking into account the previous operations in Building 991 (i e , predominately storage of SNM in Type-B containers) this building was not included the duct holdup program The USQD potential of holdup in Buildings 776 and 779 is discussed in the USQD Question section

Radiological Protection requires evaluating the radiation fields that help identify significant accumulations of material Also, Safeguards and Security program develops and implements policies and procedures which provide for the physical security, control and accountability of special nuclear material This is done with assistance from Statistical Application and Safeguard Measurements groups Through the use of statistics and NDA measurements, these groups also help identify locations of duct hold-up and minimize assay errors

G V = 5 Plutonium is stored in structures that are not seismically qualified for the present design basis earthquake (Building 371 excepted) This potentially increases the material available from events, caused by the first four vulnerabilities listed above, due to damage to packaging or confinement systems

The plutonium facilities' FSARs quantitatively addresses risk to the public This information is used as part of the authorization basis for facility operations Based on the existing FSARs and other recent analyses, risk to the public from plutonium buildings is dominated by earthquake and wind events In view of this conclusion, Buildings 559 (wind only), 707A, and 779 were structurally upgraded in the late 1980s to withstand the design basis earthquake and wind events Building 371 is designed to withstand the design basis accidents Most plutonium at Rocky Flats Environmental Technology Site is currently stored in vaults or vault-type rooms which provide greater protection from accidents or natural phenomena events than glovebox storage The natural phenomena events (earthquakes, winds, tornadoes) are reviewed in the Management Plan As identified in USQD-RFP-93 1170-TLF, the plutonium storage issue represents an inadequacy in terms of the FSAR basis because of the increase of dispersible material from increased storage time, under severe accident conditions (earthquake), an increase in the amount of oxide could result in an increase in radiological consequences to the public

The Rocky Flats Environmental Technology Site buildings' FSARs show that risk to the public is dominated by lower probability seismic and extreme wind events rather than the higher frequencies of potential fires, explosions, and spills Currently, most of the pyrophoric powders and flakes are stored in Zone I vaults or Zone II vault-like rooms which generally provide greater structural resistance to natural phenomena forces The risk to the worker from plutonium is managed by a low occupancy rate and work place monitoring such as SAAMs

G V # 6 Hundreds of plutonium items stored at Rocky Flats Environmental Technology Site are out of compliance with the plant fire safety procedure (HSP-31 11) Certain of these items have a limited storage life, after which they have to be unpacked in a controlled environment and visually inspected to determine the amount of plutonium oxide formed during storage The oxide and plutonium fines are considered pyrophoric until thermally stabilized and may burn in an air atmosphere

HSP-31 11, 'Transfer and Storage of Plutonium for Fire Safety" defines the interim responsibilities and requirements for packaging, transferring, and storing plutonium, Pu oxides, and Pu compounds to minimize the possibility of Pu fires until long term transfer and storage requirements are determined USQD-RFP-93 1170-TLF evaluates the storage of potentially pyrophoric Pu as it has been from the curtailment of production operations in December 1989 to September 1993 This includes the failure to comply with the requirements of HSP/FLP-31 11, "Transfer and Storage of Pyrophoric Plutonium for Fire Safety" dated May 8, 1991, as described in Occurrence Report RFO-EGGR-SITEWIDE-1993-0002, and the continuing increase in the quantity of dispersible plutonium oxides present at Rocky Flats Environmental Technology Site Compensatory Actions defined in the above USQD address measures to reduce risk to workers and the public and to prevent the probability and consequences of potential accidents As an immediate compensatory action, Standing Order No 21 was issued on May 4, 1993 by the EG&G Rocky Flats General Manager which established restrictions on handling potentially pyrophoric plutonium Other corrective actions are addressed in the "Management Plan for Resolution of Safety Issues Associated with the Storage of Plutonium "

Four basic corrective actions are identified in the Assessment which could lower the impacts of vulnerabilities 1) stabilize solutions and pyrophoric materials, 2) repackage solids in a suitable container for interim storage, 3) move plutonium into seismically-secure facilities for storage, and 4) verify double contingency compliance for criticality material limits

Material stabilized and/or repackaged in seismic containers to minimize long-term dispersibility will not necessarily have to be stored in a seismically-secure facility Intra-plant shipments of plutonium materials are controlled by the *Rocky Flats Plant Transportation Safety Manual* Intra-plant shipments are contained in currently or formerly approved for off-site shipment containers

FAILURE MODE, HAZARD, AND ACCIDENT IDENTIFICATION

Plutonium metal exposed to air (21% oxygen) will form plutonium oxides In an inert atmosphere (less than 5% oxygen), plutonium metal will still oxidize, but more slowly than in air Plutonium metal exposed to hydrogenous materials such as water, water vapor in air, or plastic may form plutonium hydride Other plutonium corrosion reactions are possible, but less significant Some of the resulting plutonium compounds are pyrophoric or combustible Plutonium metal with a high surface area to mass ratio is also pyrophoric Under some conditions, these materials may ignite spontaneously and may ignite surrounding combustible materials including plutonium metal

Various mechanisms may cause containers of plutonium to leak or rupture As plutonium metal oxidizes, its volume increases, and the resulting expansion may cause a mechanical rupture of its container Plutonium oxide has a large surface area which can adsorb moisture Slight heating can cause desorption of some of this moisture and a sudden pressurization of the container Plastic bags, tape used to seal Vollrath cans and plastic bags, and the latex seal on produce cans degrade over time from radiolytic decomposition and loss of plasticizers Other mechanisms may also result in container failures Common plutonium compounds such as oxides and hydrides are dispersible powders Therefore, any operational accident or natural phenomena event such as a spill, fire, explosion, criticality, wind, tornado, or earthquake which could cause a breach of containment could result in a release of plutonium

Postulated Events

The process used by the team of experts to determine the vulnerabilities is qualitative and subjective The team did not perform numerical calculations but agreed on the likelihood or consequence of a particular vulnerability event belonging to a particular range The Assessment identified 10 types of events and a total of 54 combined events The types of events are 1) facility fire, 2) explosion, 3) leakage/spill, 4) loss of confinement, 5) criticality, 6) breach of container, 7) material fire, 8) external exposure, 9) earthquake, and 10) aircraft crash The events are generic enough that a description of a leakage/spill event is the same for every building This is based on that each of the buildings has roughly the same kind of material in the same kind of containers Other than the facility fire event for Building 776, the only events as indicated by the Assessment to have potential impacts to public safety are earthquake, explosion, and aircraft crash Each of the events are tabulated in Public Safety and Worker Matrices These are shown in Tables 13 and 14 The event identifier indicates the building number, the type of event and the timing of the corrective actions

Each event type is discussed presenting a synopsis of the event and comments for comparisons to the FSARs The general vulnerabilities are contributing factors and adverse conditions to the individual vulnerability events As the general vulnerabilities have already been presented additional expatiation of the adverse conditions is not needed The assessment methodology is not as rigorous as the risk analysis in the various FSARs However, within the discussion of each event are factors for which that an assessment performed by FSAR risk analysis methods would have taken either explicit or implicit credit.

Table 13 Public Safety

Likelihood	Consequences: High		Medium	Low
High				
Medium				
	Bldg-Event ID/Type	NT/LT		
Low	559-09 Earthquake	2		
	707-09 Earthquake	2		
	771-09 Earthquake	2		
	776-09 Earthquake	2		
	779-09 Earthquake	2		
	559-02 Explosion	1		
	707-02 Explosion	1		
	771-02 Explosion	1		
	776-02 Explosion	1		
	779-02 Explosion	1		
	559-10 Aircraft Crash	1		
	776-10 Aircraft Crash	1		
	779-10 Aircraft Crash	1		
	776-01 Facility Fire	2		

Note 2 indicates Near Term and 1 indicates Long Term corrective actions

Table 14 Worker Safety

Likelihood	Consequences: High — Bldg-Event ID/Type	NT/LT	Medium — Bldg-Event ID/Type	NT/LT	Low — Bldg-Event ID/Type	NT/LT
High					371-03 Leakage/Spill	2
					559-03 Leakage/Spill	2
					771-03 Leakage/Spill	2
					776-03 Leakage/Spill	2
					779-03 Leakage/Spill	2
					371-06 Breach Contnr	2
					559-06 Breach Contnr	2
					707-06 Breach Contnr	2
					771-06 Breach Contnr	2
					776-06 Breach Contnr	2
					779-06 Breach Contnr	2
					991-08 Extn Exposure	2
					371-07 Material Fire	2
					559-07 Material Fire	2
					707-07 Material Fire	2
					771-07 Material Fire	2
					776-07 Material Fire	2
					779-07 Material Fire	2
					371-04 Loss Confmnt	2
					559-04 Loss Confmnt	2
					707-04 Loss Confmnt	2
					771-04 Loss Confmnt	2
					776-04 Loss Confmnt	2
					779-04 Loss Confmnt	2
Medium						
Low	371-05 Criticality	2	559-09 Earthquake	2	371-01 Facility Fire	2
	707-05 Criticality	2	707-09 Earthquake	2	559-01 Facility Fire	2
	771-05 Criticality	2	771-09 Earthquake	2	707-01 Facility Fire	2
	776-05 Criticality	2	776-09 Earthquake	2	776-01 Facility Fire	2
	779-05 Criticality	2	779-09 Earthquake	2	771-01 Facility Fire	2
			559-08 Extn Exposure	2	779-01 Facility Fire	2
			707-08 Extn Exposure	2		
			771-08 Extn Exposure	2		
			776-08 Extn Exposure	2		
			779-08 Extn Exposure	2		
			371-02 Explosion	1		
			559-02 Explosion	2		
			707-02 Explosion	1		
			771-02 Explosion	1		
			776-02 Explosion	1		
			779-02 Explosion	1		
			559-05 Aircraft Crash	1		
			776-10 Aircraft Crash	1		
			779-10 Aircraft Crash	1		

Note 2 indicates Near Term and 1 indicates Long Term corrective actions

Leakage/Spill Event
Assessment Description

The storage of plutonium solutions in plastic bottles or tankage for extended periods of time, generates conditions that are conducive to actual degradation of the container Degradation of the containers may injure and/or expose near-by workers and/or contaminate the immediate facility areas Leakage/spills may occur either during handling of the container or while the container is in a stationary storage position The curtailment of site-wide nuclear operations significantly inhibits the processing of material into forms suitable for long term storage Recurrent facility safety system equipment failures, as well as inadequacies in configuration knowledge and administrative controls, reduce the likelihood of approval for conduct of the nuclear operations required to stabilize the solutions in storage

This type of event is rated as high likelihood and low worker safety impact The timing of corrective action should be near term due to continued degradation of current material storage conditions

Adverse Conditions

Radiation levels of material in storage in combination with current material packaging configurations increase the likelihood of packaging failures Additionally, several gloveboxes are severely corroded from prior usage, enhancing the likelihood of solutions entering the glovebox room in the event of leakage/spills (applies to Buildings 371, 559, 776, 779) Recurrent facility safety system equipment failures, as well as inadequacies in configuration knowledge and administrative controls, reduce the likelihood of approval for conduct of the nuclear operations required to stabilize the solutions in storage

Comments and Comparison to FSARs

Containers imply plastic bottles as well as piping and tanks The plutonium solutions include acidic solutions which are corroding tank and piping walls

The FSARs analyzed spills of liquids and powder in different locations Due to the low energetics associated with spills and the mitigation provided by HEPA filters, this type of accident does not significantly contribute to the public risk curves The different locations include inside gloveboxes, in rooms, or modules, on the second floor, and on docks The mitigating systems that are directly relied upon include 1) operator response, 2) gloveboxes which includes gloves and bags, 3) Selective Alpha Air Monitors (SAAMs), 4) ventilation systems which provide pressure differential and HEPA filtration of the room and glovebox ventilation system exhaust. Secondary mitigating systems include the electrical power/back-up systems and Life Safety Disaster Warning System

Analysis of generic liquid spills in Building 771 include Batch Feed, Evaporator Feed, and Peroxide Precipitation with respective spill initiating event frequencies of 0 2, 1 0 and 3 0 per year The initiating event frequency is based on interviews with operators This is consistent with the initiating event frequency assumed in the Assessment The FSAR relied upon the operator to control and isolate the spill within less than 5 minutes The probabilities of failure of this are 10% for well occupied areas, 50% in areas with few people, 100% for remote or unoccupied areas Curtailed operations and restricted access to process areas decreases the percentage of time an area is occupied, decreasing the probability of containing and isolating a spill However, curtailed operations have reduced the probability of having a spill, off setting this increase The consequences from the plutonium nitric acid spill does not change because the accident analysis used a release fraction rather than a release rate, yielding a time invariant calculation This leads to a more conservative calculation

Breach of Container Event
Assessment Description

Breach of container is likely due to the physical condition of material in storage, and its packaging configuration The current material storage configurations, when existing for extended periods of time, generate conditions that are conducive to either actual degradation of the container or induced failure of the container A container breach is the loss of physical integrity of the primary container that hold the plutonium This includes the plastic around dry material or cans the tape which keeps the lid of the can in place, tanks, piping, plastic bottles, or sometimes gloveboxes A failure of containers may injure and/or expose near-by workers and/or contaminate the immediate facility areas These failures may occur either during handling of the container or while the container is in a stationary storage position

Adverse Conditions

Radiation levels of material in storage in combination with the current material packaging configurations increases the likelihood of packaging failures Potential failure mechanisms are container pressurization, radiolytic degradation of the container, and container failure due to volumetric expansion of material, among others Recurrent facility safety system equipment failures, as well as inadequacies in configuration knowledge and administrative controls reduce the likelihood of approval for conduct of the nuclear operations required to stabilize the material in storage Equipment failure predominately results from age of equipment and lack of preventive maintenance Equipment failure degrades safety system performance Equipment age adversely affects performance due to the general inability to obtain replacement parts and reduced operational reliability The rate of equipment failure has been increasing in recent years The lack of a rigorous preventive maintenance contributes to the time dependent physical degradation of equipment.

This type of event is rated as high likelihood and low worker safety impact The timing of corrective action should be near term due to continued degradation of current material storage conditions

Comments and Comparison to FSARs

It is a fact some of the containers are degrading and a breach is more likely than what is estimated in the FSARs This aspect is identified in USQD-RFP-93 1170-TLF Release of material upon a breach of container is considered a spill (liquid or dry), these events have been analyzed in the FSARs A more complete description of spills is described in the Spill Event section

Material Fire Event

Assessment Description

The current material storage configurations, when existing for extended periods of time, generate conditions suitable for auto ignition of material and/or its packaging Plutonium metal is stored in unsealed containers, in non-inerted environments, and utilizes plastic for containment. Ignition of material and/or its packaging may injure or expose nearby workers, contaminate the immediate facility, or could ignite co-located combustible materials

Adverse Conditions

Radiation levels of material in storage in combination with the current material packaging configurations are creating conditions conducive to auto-ignition Examples are the generation of flammable gases (such as hydrogen) and the formation of pyrophoric material forms Recurrent facility safety system equipment failures, as well as inadequacies in configuration knowledge and administrative controls, reduce the likelihood of approval for conduct of the nuclear operations required to stabilize and repackage the material in storage Equipment failure predominately result from age of equipment and lack of preventive maintenance Equipment failure degrades safety system performance Equipment age adversely affects performance due to the general inability to obtain replacement parts and reduced operational reliability The rate of equipment failure has been increasing in recent years The lack of a rigorous preventive maintenance contributes to the time dependent physical degradation of equipment.

This type of event is rated as high likelihood and low worker safety impact The timing of corrective action should be near term due to continued degradation of current material storage conditions

Comments and Comparison to FSARs

The FSARs analyzed different types of fires which bound this type of fire These are addressed in the Facility Fire Event section Material fire risk is maintained in part by reducing combustible loading near stored material as low as possible and that material stored in vaults is not susceptible to fire propagation from one storage location to another (NSTR-0120-93) USQD-RFP-93 1170-TLF identified this issue and declared it an Unreviewed Safety Question The *Management Plan for Resolution of the Safety Issues Associated with the Storage of Plutonium* and the USQD-RFP-94 0084-TLF, which evaluated the HSP-31 11 *Transfer and Storage of Plutonium for Fire Safety* procedure address the issue in greater detail, implementing corrective actions and restrictions on the handling of potentially pyrophoric plutonium

Equipment important to safety for this type of event are heat detectors and those identified in the Facility Fire Event description

Loss of Confinement Event
Assessment Description

Equipment failures or human error causes a loss of the ventilation envelope resulting in a loss of differential pressure Material is predominately stored in conditions intended only for short-term storage Plutonium metal is stored in unsealed containers, in non-inerted environments, and utilizes plastic for containment

Adverse Conditions

Equipment failures or human error result in loss of confinement by the ventilation system Radiation levels of material are increasing due to americium buildup The current packaging configurations are degrading and creating conditions for material migration Recurrent facility safety system equipment failures, as well as inadequacies in configuration knowledge and administrative controls, reduce the likelihood of approval for conduct of site-wide nuclear operations required to stabilize and repackage the material in storage Equipment failure predominately results from age of equipment and lack of preventive maintenance Equipment failure degrades safety system performance Equipment age adversely affects performance due to the general inability to obtain replacement parts and reduced operational reliability The rate of equipment failure has been increasing in recent years The lack of a rigorous preventive maintenance contributes to the time dependent physical degradation of equipment.

This type of event is rated as high likelihood and low worker safety impact The timing of corrective action should be near term due to continued degradation of current material storage conditions

Comments and Comparison to FSARs

Loss of confinement causes suspended material (i e , Pu particles) to migrate from Zone I to succeeding Zones Thus, loss of confinement does not have to coincide with other accidents to cause contamination It can be either momentary or for extended periods of time The impacts can be localized (i e , as single glovebox or room) or globalized (all the gloveboxes in a module or room or the entire building) Excluding accidents such as fires and explosions, the causes for loss of confinement include 1) loss of glove or bag port, 2) doorway held open too long, 3) external wind pressure and vacuum, 4) pressure/flow damper related failure (i e , single damper or overall instrument air system failure), and 5) operator error

Momentary and localized loss of confinement is not an unusual occurrence SAAMs detect the migration of Pu particles Egress procedures for such an event help minimize the exposure In accordance with OSRs, operations are suspended when a pressure differential LCO can not be maintained The impacts of this type of event is minimized by adhering to egress procedures and the OSRs that require SAAMs and pressure differentials as well as other requirements to meet the LCOs while operations are in progress

Mitigating systems that are directly relied upon for this type of event are 1) SAAMs, 2) egress procedure, 3) Stationary Operating Engineer, 4) fans and ductwork, 5) control dampers and instrument air, 6) structural integrity of gloves, gloveboxes, and the building, and 7) electrical power Secondary mitigating systems include backup fans and backup electrical power

Criticality Event

Assessment Description

Material storage areas installed with less than seismic design basis racks and internal components may fail in a seismic event. Human error or inadequacy of the criticality safety limits may result in a critical configuration during a material movement.

Adverse Conditions

Inadequate seismic design combined with an earthquake and the current material storage configurations create conditions conducive to reconfiguration into a critical geometry This condition unnecessarily exposes the worker to an increased likelihood of radiation exposure and/or contamination

This type of event is rated as low likelihood and high worker safety impact The timing of the corrective action is near term due to degradation of current material storage conditions and long term due to budget constraints for seismic upgrades

Comments and Comparison to FSARs

Criticality safety is provided through several programs The Criticality Safety (CS) group manages some of these programs The Site Assessment Team, with its restrictive methodology, viewed that if one cannot guarantee a criticality will not occur then it 'may' occur Obviously, this is true, however, it is not consistent with risk assessment methodology used by the CS group and in the SARs The CS group uses a double contingency criterion for assessing the probability of occurrence of a criticality Double contingency implies that two unlikely events (i e , the probability of occurrence of an unlikely event is less than or equal to 1E-2 /year) must occur before a criticality is probable Thus, CS contests the statements made within the Assessment concerning criticalities

The Site Assessment Team did not include a Criticality Safety Engineer As such, the team was not aware of some of the previous criticality safety evaluations Several criticality accidents are evaluated in the FSARs The two types are either a metal criticality or a solution criticality The FSARs identified those areas within buildings that had the potential for criticality accidents Where appropriate fault tree analyses are performed to estimate the likelihood of a criticality accident. Some of the basic events considered in the FSAR that might contribute to an accident are 1) introduction of moderators, 2) changes in geometry, 3) double batching, 4) natural phenomena, 5) pipe breach, 6) valve left open, and 7) operational accidents

The mitigative systems associated with criticality accidents include 1) various safety and training programs, 2) procedures, 3) physical barriers, 4) lock-out/tag-out program, 5) criticality alarms, 6) Raschig rings, and 7) HEPA filters Previous reviews of applying double contingency criterion revealed that this is applied but not well documented in previous criticality evaluations Also, some of the affected operations are no longer being performed Rocky Flats Environmental Technology Site has not experienced an inadvertent criticality Criticality Safety Engineering is in the process of establishing new criticality limits for various proposed operations

External Exposure Event

Assessment Description

Personnel external exposures are received due to events that breach the facility barriers Material is predominately stored in conditions intended for short-term storage Plutonium is stored in unsealed containers, in non-inerted environments, and utilizes plastic for containment. Fires, explosions, or earthquake damage potentially allow material to be released from damaged packaging, thus exposing the external personnel

Adverse conditions

Radiation levels of material in storage in combination with the current facility packaging configurations increases the likelihood of packaging failures Earthquake challenge of containers stressed by pressurization radiolytic degradation of the container, and container failure due to volumetric expansion of material, among others increase the severity Recurrent facility safety system equipment failures, as well as inadequacies in configuration knowledge and administrative controls, reduce the likelihood of approval for conduct of the nuclear operations required to stabilize the material in storage

Comments and Comparison to FSARs

This event encompasses fire, explosion and earthquake events However, the focus is on the set of workers not directly connected with operations within a particular building This set of workers are not explicitly addressed in the FSARs In addition to all the other precautions to keep the risk from such events to a minimum, procedures within emergency planning have these persons take sheltering actions or possibly evacuation

Explosion Event
Assessment Description

The generic explosion can breach the facility structure and release radioactive material directly to the atmosphere This event is postulated for Buildings 559, 707, 771, 776, and 779 The material is stored in rooms, vaults, or gloveboxes

A human error may lead to an oxyacetylene explosion within a room containing both material in storage and with an exterior wall

Adverse Conditions

Oxy-acetylene bottles associated with maintenance activities may be present within the facility Increasing degradation of material and its packaging increases the quantity of material available for release Material is predominately stored in conditions intended only for short term storage Plutonium is stored in unsealed containers, in non-inerted environments, and utilizes plastic for containment The curtailment of site-wide nuclear operations significantly inhibits the processing of material into forms suitable for long term storage Recurrent facility safety system equipment failures, as well as inadequacies in configuration knowledge and administrative controls, reduce the likelihood of approval for conduct of the nuclear operations required to stabilize the solutions or material in storage Equipment failure predominately results from age of equipment and lack of preventive maintenance Equipment failure degrades safety system performance Equipment age adversely affects performance due to the general inability to obtain replacement parts and reduced operational reliability The rate of equipment failure has been increasing in recent years The lack of a rigorous preventive maintenance contributes to the time dependent physical degradation of equipment

Compensatory measures that reduce the severity of the vulnerability are as follows Personnel access to areas containing material in storage is tightly controlled Facility operations instructions have been implemented to minimize the presence of oxy-acetylene bottles in rooms/vaults containing both exterior walls and material storage

This type of event is rated low likelihood and medium worker safety impact and high impacts on public safety The timing of corrective action should be long term due to administrative measures that have been implemented

Comments and Comparison to FSARs

The FSARs analyzed several explosion scenarios Some of these are associated with certain processes, such as briquetting, molten salt/foundry hydrogen, or ion exchange processes Some of these processes are no longer being performed or have been significantly scaled down The other class of postulated explosion accidents are generic explosions involving oxy-acetylene bottles during welding activities The Assessment indicates concern about explosions in gloveboxes, room, and vaults that have the potential to damage an exterior wall It is also concerned that the degradation of material (i e , oxidation of Pu metal) and packaging increases the quantity of material available for release

The mitigating systems that are directly relied upon include 1) physical structure (i e , breaching a wall), 2) room ventilation, maintaining negative pressure, 3) the exhaust is filtered through HEPA filters, 4) glovebox confinement systems remain intact during an ensuing fire, 5) automatic sprinkler suppression, and 6) interior and exterior fire walls Secondary mitigating systems include 1) the detection and suppression of a secondary fire by operator and/or the building emergency support team suppression or isolation of the fire by the Fire Department, 2) various alarm systems (e g , sprinkler system flow sensors), and 3) protection of the MAR in various secondary containers such as drums, gloveboxes, and vaults

The FSARs analyzed explosions in gloveboxes, rooms, and hallways Breaching a wall is considered as a possibility and incorporated into the event tree models Explosions in vaults are not considered because oxy-acetylene is not permitted in vaults or vault type rooms If for some reason welding in a vault is required, then the proposed activity would be reviewed through the SES/USQD process USQD-RFP-93 1170-TLF identified the issue of metal oxidation increasing the MAR as an Unreviewed Safety Question The containers that are degrading are those of plastic bags which are stored in metal drums Since these plastic containers are inside other containers and the FSAR did not take credit for these types of containers, the identified issue associated with explosion have already been identified or would not impact FSAR analyses

<u>Facility Fire Event</u>
<u>Assessment Description</u>

Human error results in the ignition of combustible loading of the facility The current residue storage configurations generate conditions suitable for ignition of residues and/or its packaging Ignition of residues and/or its packaging may ignite co-located combustible materials

<u>Adverse Conditions</u>

Material is predominately stored in conditions intended only for short-term storage Radiation levels of material in storage in combination with the current material packaging configurations are creating conditions conducive to auto-ignition Examples are the generation of flammable gases (such as hydrogen) and the formation of pyrophoric material forms Recurrent facility safety system equipment failures, as well as inadequacies in configuration knowledge and administrative controls, reduce the likelihood of approval for conduct of the nuclear operations required to stabilize and repackage the material in storage Equipment failure predominately results from age of equipment and lack of preventive maintenance Equipment failure degrades safety system performance Equipment age adversely affects performance due to the general inability to obtain replacement parts and reduced operational reliability The rate of equipment failure has been increasing in recent years The lack of a rigorous preventive maintenance contributes to the time dependent physical degradation of equipment.

Compensatory measures that reduce the severity of the vulnerability are as follows Personnel access to area containing residues in storage is tightly controlled Activities involving the movement of residues are significantly restricted to minimize the likelihood of ignition Fire protection upgrades since the Building 776/777 fire in 1969 have minimized the probability of a facility fire breaching the confinement systems

This type of event is rated as low likelihood and low worker safety impact and not applicable to public safety for all buildings except for Building 776 This event for Building 776 has a rating of high impact to public safety because the review team predicts a fire will breach the exterior walls These walls are not NFPA fire rated walls The timing of corrective action should be near term due to continued degradation of current material storage conditions

<u>Comments and Comparison to FSAR</u>

The FSARs analyzed fires in different locations The different locations include inside gloveboxes, in rooms or modules, on the second floor, and on docks The mitigating systems that are directly relied upon include 1) availability of nearby combustibles, 2) detection and suppression of the fire by operator and/or the building emergency support team, 3) suppression or isolation of the fire by the Fire Department, 4) glovebox confinements system intact during the fire, 5) automatic sprinkler suppression, 6) room ventilation attempts to maintain negative pressure and filter the exhaust, and 7) fire walls interior and exterior Secondary mitigating systems include the various alarm systems, fire water distribution system, and automatic and manual deluge system in the filter plenum

The initiating events in the event trees are based on operating history These include human error caused events The adverse condition of material stored in conditions intended for short term storage has been previously identified in USQD-RFP-93 1170-TLF and corrective actions in the "Management Plan for Resolution of the Safety Issues Associated with the Storage of Plutonium " The Assessment lists recurrent facility safety system failures as an adverse condition These systems are directly relied upon to maintain risk within the authorization basis

The FSAR analyzed the aspect of a facility fire breaching the wall of Building 776, taking credit for the many fire safety improvements made after the 1969 fire The analysis indicates that for this to occur, sprinkler systems, as well as all other fire mitigating systems, would have to fail The annual probability of this occurring is 7 1E-09 This is not a credible event.

Earthquake Event

Assessment Description

The occurrence of a seismic event may produce sufficient failure of internal structures and systems to produce a release of airborne radioactive material Plutonium material is predominately stored in plastic bottles, in unsealed containers or in non-inerted environments Additionally, the curtailment of nuclear operations significantly inhibits the processing of material into forms suitable for long term storage These storage conditions generate increasing quantities of material in dispersible form, increasing the material available for release during a seismic event. This condition unnecessarily exposes the worker and environment to an increased likelihood of radiation exposures and/or contamination This condition unnecessarily exposes the public to an increased likelihood of contamination

Adverse Conditions

External structures have not been upgraded to withstand seismically induced ground accelerations of 0 21 g (Applies to Buildings 559, 707-not 707A, 771 and 776/777) Some internal structures and components have not been seismically upgraded (Applies to Buildings 559, 707, 771, 776, and 779) Increasing degradation of material and its packaging increases the quantity of material available for release (Applies to Buildings 559, 707, 771, 776, and 779) Recurrent facility safety system equipment failures, as well as inadequacies in configuration knowledge and administrative controls, reduce the likelihood of approval for conduct of nuclear operations required to stabilize the material in storage (Applies to all buildings) Equipment failure predominately results from age of equipment and lack of preventive maintenance Equipment failure degrades safety system performance Equipment age adversely affects performance due to the general inability to obtain replacement parts and reduced operational reliability The rate of equipment failure has been increasing in recent years The lack of a rigorous preventive maintenance contributes to the time dependent physical degradation of equipment

This type of event is rated as low likelihood and medium worker safety impact and high impacts on public safety The timing of corrective action should be near term due to continued degradation of current material storage conditions, increasing the quantity of material in dispersible forms

Comments and Comparison to FSARs

The FSARs analyzed risk from earthquakes that produce an acceleration of 0 14 g at bedrock For Rocky Flats Environmental Technology Site this is approximately equivalent to an earthquake that produces 0 21 g acceleration at the surface These analyses addressed building structural damage as well as component failure The fact that more material is in a more dispersible form has been identified and declared an Unreviewed Safety Question in USQD-RFP-93 1170-TLF The weakened pipes and tanks are more likely to release their material at lower threshold earthquakes

Aircraft Crash Event
Assessment Description

The occurrence of an aircraft crash may produce sufficient failure of internal structures and systems to produce a release of airborne radioactive material The resulting fuel fire provides an energy source for dispersion

Adverse Conditions

The external structure of the buildings are not designed to withstand aircraft penetration Internal structures and components (e g , glovebox systems) are similarly designed Increasing degradation of material and its packaging increases the quantity of material available for release

Comments and Comparison to FSARs

Aircraft crashes are not explicitly analyzed within the FSARs However, they are analyzed in the 1980 Final Environmental Impact Statement for Rocky Flats and are used to help develop emergency planning zones USQD-RFP-93 1170-TLF identified and declared the issue of material degradation with respect to plutonium oxidation and non-compliance with HSP-31 11 as an Unreviewed Safety Question

UNREVIEWED SAFETY QUESTION DETERMINATION QUESTIONS

Discussion

The purpose of this USQD is to determine if the conditions described in the Assessment represent significant enough changes in the authorization bases to be classified as a USQ The conditions are general vulnerabilities and individual vulnerability events A synopsis of the Assessment and the assessment methodology are presented in the above text Also presented are the discussions of the general vulnerabilities and events, providing additional information to characterize the vulnerability and a comparison to the SAR risk assessment methodology, respectively The USQ potential of each of these is discussed below Due to the length of this USQD a minimal amount of summary information is presented, the reader is asked to refer to the general vulnerability section for additional information

USQD Potential of the Vulnerability Events
The Assessment qualitatively placed individual events into frequency and consequence bins This is based on a review of the conditions of the plutonium, it's packaging, and adverse conditions Quantities or proportion of material in each type of container is not given The physical barriers are identified however, a measure of their effectiveness under accident conditions is not characterized Magnitudes of individual events (e g , size of spill or fire) are not quantified or described The degree of mitigation provided by compensatory measures is not estimated in the Assessment.

Individual scenarios in the FSARs were developed through a rigorous process This process included 1) a comprehensive review using a preliminary hazard assessment technique to identify significant potential accident events, 2) an estimation of the annual probabilities of these events through the use of fault trees, statistical data, and engineering judgment, 3) development of accident propagation by estimating the probabilities of success of different mitigating systems, and 4) based on accident propagation involving the MAR, consequences were calculated in terms of dose (i e , rem) The results of this process yielded a numerical estimation of the annual probability and consequence (i e , risk when multiplied) of individual accident scenarios Thus, many factors were considered and quantified in developing FSAR risk curves

Compared to the rigorous process used in the FSARs to develop individual scenarios, the Assessment methodology is a comprehensive Preliminary Hazard Assessment (PHA) PHAs are often very conservative in their estimates Also, some the statements (e g , a fire results from human error or an event may potentially occur) within the Assessment are not consistent with terms and methodology used in the SARs The frequency and consequences bins, as defined in the Assessment, are significantly different than what has been established for the SAR analyses For example, the frequency bins for SARs usually span two orders of magnitudes (a factor of 100), while the Assessment used bins that span a few years (e g , 3 years) The Assessment did not substantiate, in terms of numerical calculations or referenced documents, the placement of various events into the bins Validating the placement of the events into the bins would require a SAR type risk analysis, which is beyond the scope of this USQD Therefore, it is inappropriate to consider the individual vulnerability events is this USQD However, the USQ potential of the six general vulnerabilities are discussed below

<u>USQ Potential of the General Vulnerabilities</u>

The six general vulnerabilities are presented in the Safety, Operating Function, and Operation Conditions Identification section Additional information is presented with the general vulnerabilities to identify whether the issue had been previously evaluated with the USQD process and estimate the extent and magnitude of the vulnerability Summarizing this information, this section discusses the USQ potential of the six general vulnerabilities Please refer to the section mentioned above for additional information

GV # 1 identifies that plutonium solutions (acidic & caustic) are degrading the storage containers (i e , plastic bottles, system piping and tanks) This condition has not been previously evaluated through the USQD process

Two LANL Assessments document the LATO findings related to this condition Their findings include

- An organized database does not exist from which to predict the stability of solutions and resins,
- Nitric acid inhibits corrosion by passivating the surface For red fuming nitric acid (which is more concentrated than the nitric acid found in the RFETS tanks) a corrosion rate of 6E-4 inch per year is typical,
- The predominant sources of leaks are gaskets, joints, and valve failure,
- This condition has the potential to create serious safety hazards

Leaving the solution in the tanks may also lead to stratification of the plutonium solution and radiolysis of the water molecules in the solutions The Criticality Safety group has reviewed conditions that could lead to stratification with the current status of the tanks Based on current information none of the tanks present these conditions Radiolysis of the water molecules generates hydrogen This condition is evaluated in USQD-RFP-95 0387-CAS, *Gaseous Hydrogen Generation and Accumulation in Solution Tanks in Buildings 371 and 771* The evaluation determined that an accident of a new type is created by this condition, resulting in a positive USQ

Conversations with Larry Peppers of Material Surface Technology indicates corrosion problems experienced at RFETS are related to localized impacts to joints and valves Generalized corrosion of tanks have not been experienced A few lines in Building 771 have experienced corrosion problems These, however, are not new problems This vulnerability is directly related to spill accidents Standing Order 39, *Management of Bottled Actinide Solutions*, provides guidance on the management of aqueous solutions The guidance specifies the types of plastic bottles for aqueous plutonium solutions and storage requirements Polypropylene bottles containing aqueous solutions with actinide concentration greater than 1 mg/l shall be repacked into low density polyethylene or high density polyethylene bottles as soon as practicable and in no case shall polypropylene bottles containing actinide solution be placed into drums for storage or shipment. The bottles are periodically vented, relieving hydrogen accumulation

SAR risk assessments have evaluated spills in all frequency bins The frequency of spills in the FSARs is based in part on plant historical data This data takes into account operator error and equipment malfunction However, these contributing categories were not delineated in the initiating event frequency

The basis that the probability of spills has not increased above that in the FSARs is a qualitative evaluation of the operations while production was being performed (24 hours a days) to the few operations that are ongoing With the many Justification of Continued Operations in place for the various out-of-tolerance conditions the number and type of operations are severely restricted compared to that in the FSARs Considering these factors although the failure probability of plastic containers has increased, the overall probability of a spill has not increased

Summarily, though leaving the solutions in tanks is not wise and may have increased the probability of spills, it is qualitatively determined that the increase is not significant and that no new significant hazards have been generated by this condition Therefore, this condition does not warrant a positive response to any of the seven USQD questions

GV # 2 identifies that plutonium is stored in contact with plastic and other organic material increasing the fire hazards This issue is identified as an Unreviewed Safety Question in USQD-RFP-93 1170 TLF

GV # 3 identifies that the VSSs are degrading and with the concurrent loss of experienced plutonium handlers lengthens both the "hands-on" duration of an activity and the calendar time to complete the activity

The Assessment identified the age of equipment and lack of preventive maintenance as adverse conditions These factors could lead to increasing failure rates and counter assumption used to predict system reliability The search of several data bases did not reveal any increasing trend of equipment failure The LCO, compensatory measure, and MWCFs in this determination specifically relate to VSS MWCFs related to Zone II HVAC system for Building 707 are specifically reviewed The data bases are not constructed to predict failure rates, and influencing factors such as resumption are evident on the number of MWCFs that are submitted Repair times for two components of the HVAC system are estimated All of these data indicate that the VSS availability has decreased Availability estimates use repair times and failure rate data The above data sources provide good indication that repair time have significantly increased The data sources did not have the type of data needed to estimate failure rates

Several examples of system degradation are provided in the above text The examples showed a decrease in HVAC functionality as well as for other systems When appropriate, compensatory measures are implemented to offset the decreased functionality A review of the compensatory measures in Bldg 707 indicates that there are currently too many compensatory measures to be effectively implemented The reasons for this are (1) the large number of shift orders in which the measures are contained, (2) the high turnover rate of the compensatory measures, and (3) managing the implementation relies heavily on memory A compensatory measure does not provide the same function nor reliability as the safety component it replaces Qualitatively, equipment protective features have been modified, degrading the functionality of the VSSs beyond that assumed in the accident analysis chapter in the FSARs

Though the MWCF completion time is not a good indicator of repair time, the repair time has significantly increased from the values assumed in the FSARs The increases shown in the above text are as large as a factor of 300 The increase is attributed to availability of various personnel, lack of spare parts and implementation of the structured and time consuming Integrated Work Control Process Longer repair times increases component and system unavailability The conditions and aspects that impact the unavailability of the HVAC system are prevalent for repairs on all VSS Unavailability of VSS may have secondary impacts For example increasing the unavailability of the nitrogen system may increase the probability of self-ignition of plutonium Quantifying unavailabilities for all of the VSSs for all of the buildings is beyond the scope of this USQD

The qualitative assessment of the increase in system repair time combined with (1) decreased functionality of VSS and (2) significant number of compensatory measures increases the probability of occurrence of a malfunction of equipment important to safety The increased repair time leading to increased system unavailability combined with decreased VSS functionality and deficiencies with implementation of compensatory measures creates the possibility of an accident of a new type The new accidents are the loss of a VSS concurrent with an accident. This is largely evaluated in the FSARs as being incredible It is now a credible accident The OSRs and the accident analysis chapter of the FSARs implicitly credit maintaining the facility and equipment in a safe condition Therefore, all of the aspects related to this general vulnerability have decreased the margin of safety as defined in the basis of the OSRs/TSRs However, these new accidents fall in the extremely unlikely bin frequency bin (i e , $10^{-6} \leq f > 10^{-4}$ per year) This bin is dominated by earthquake event risks

GV # 4 identifies that material inventory differences potentially increases the consequences of a postulated event by an estimated 20 to 25 percent

The most significant inventory difference that could increase the consequence is that associated with duct holdup As presented in previous text, several studies have estimated this amount of holdup and its locations This is shown in Table 12 Three USQDs have been performed, addressing this issue for Buildings 559, 707, and 771 This is currently being evaluated for Building 371 Of these only Building 771 has resulted in USQ condition, however, the USQD is based on new holdup estimates (approximately 80 kg) The new estimates include holdup in gloveboxes Taking into account previous operations in Building 991 (i e , predominately storage of SNM in Type-B containers) this building was not included the duct holdup program

A rough estimate as to whether the consequences might pose a USQ for the remaining buildings is performed by comparing the ductwork holdup estimates to the radiological decision criteria the buildings This is shown in the Table 15 Only PC-2 for Building 776/777 is more restrictive than that for Building 771 It is approximately 33 times more restrictive, while the holdup is approximately 8 time less The holdup quantities do not include holdup in gloveboxes or untoward areas When the hold-up is characterized and analyzed as part of the Decontamination and Decommissioning plans for the other buildings, this could represent a USQ However, the USQD related to holdup should be performed at that time

Table 15 Comparisons of Ductwork Holdup and Radiological Decision Criteria (50-year bone dose)

Building	Holdup (kg)	PC-2	PC-3	PC-4
771	33 1	1E-5	4E-3	1E-1
776/777	4 2	3E-7	1E-0	1E-0
779	1 5	4E-2	4E-0	1E+1

GV # 5 is that plutonium is stored in structures that are not seismically qualified for the present design basis (Building 371 excepted)

This potentially increases the material available from events caused by the first four vulnerabilities listed above due to damage to packaging or confinement systems The FSARs analyzed the risks from earthquake Based on operations being performed, the FSARs estimated the MAR (e g , calculating a residence time factor which establishes when the material is a risk in the gloveboxes) With many of the operations no longer being performed or significantly reduced, most of the plutonium is stored in vaults or vault type rooms Storing material in vaults decreases the material at risk and consequences for seismic events This is because (1) material in vaults are in at least 2 containers compared to bare or uncontained material in gloveboxes, (2) the material is not distributed throughout the gloveboxes, reducing the probability of material being impacted by falling debris, and (3) the vaults have greater structural integrity than gloveboxes The first four general vulnerabilities may contribute to this vulnerability However, based on the qualitative nature of the Assessment and that these vulnerabilities have been already identified as a USQ (ref 2nd vulnerability above), and do not individually represent a USQ, it is qualitatively determined that this vulnerability does not pose a USQ condition

GV # 6 identifies that hundreds of plutonium items are out of compliance with the plant fire safety procedure (HSP-31 11) This was previously determined to represent an Unreviewed Safety Question in USQD-RFP-93 1170-TLF

Note: ***The reader is encouraged to read the text presented above and in the Safety, Operating Function, and Operating Conditions Identification section for additional information regarding justification for the responses to the USQD questions***

1 **Could the proposed activity increase the probability of occurrence of an accident previously evaluated in a Safety Analysis? Yes __ No __ Explain**

G V	Response	Explanation
1	No	Plutonium solutions degrade plastic containers As reviewed, plutonium nitrate solutions are compatible with stainless steel with very low corrosion rates The nitric solutions cause leaks predominately at valves These leaks have occurred at RFETS The SARs analyzed leaks in all of the frequency bins The overall probability of spills has not increased above the values in the FSARs This is attributed to the lack of production
2	Yes	This is determined to represent a USQ in USQD-RFP-93 1170-TLF "The reason for the increase in probability since it was analyzed in the 1987 FSARs is that far more plutonium is in storage containers and the plutonium in storage containers is sitting for much longer periods than was previously common '
3	No	Degradation of the VSS does not change the initiating frequency of occurrence of accidents
4	No	Possible increase of MAR does not impact the frequency of occurrence of accidents
5	No	The FSARs analyzed the risks from earthquake This general vulnerability does not increase the frequency of seismic events
6	Yes	This is determined to represent a USQ in USQD-RFP-93 1170-TLF 'The reason for the increase in probability since it was analyzed in the 1987 FSARs is that far more plutonium is in storage containers and the plutonium in storage containers is sitting for much longer periods than was previously common '

2 **Could the proposed activity increase the consequences of an accident previously evaluated in a Safety Analysis? Yes __ No ___ Explain**

G V	Response	Explanation
1	No	The SARs analyzed spills during production The quantities of solutions available for spills have not changed since cessation of production Aged and degraded plastic bottles do constitute a common mode of failure However, the bounding consequences of spills are not impacted because the FSARs estimated larger quantities than those associated with spills from bottles This is based on (1) bottles generally leak, which is detectable, before they break, and (2) bottles are handled one at a time Therefore, the consequences have not changed
2	Yes	This is determined to represent a USQ in USQD-RFP-93 1170-TLF 'Because relatively non-dispersible plutonium metals are being converted over time into dispersible plutonium compounds and the number of containers with dispersible compounds present is increasing, the quantity of plutonium that may be released from a postulated accident is increasing '
3	No	VSS degradation does not impact the Material-At-Risk VSS degradation impacts the probability that a given VSS system is available to respond to a specific scenario The VSS degradation will impact the split fraction (success/ failure probabilities) used in the event trees and not the consequences In other words, there is a given consequence associated with the success of a VSS, and a different consequence associated with its failure Changing the success/failure probabilities does not change the associated consequences It may make the other consequences more probable than previously considered The consequence bins are largely dominated by releases associated earthquake events

4	Yes	Three USQD have been performed, addressing this issue for Buildings 559, 707, and 771 This is currently being evaluated for Building 371 Based on new hold-up estimates only Building 771 represented a USQ condition in USQD-771-94 1592-BJS Each of the remaining buildings should be individually evaluated as part of the Basis of Interim Operation
5	No	The FSARs analyzed the risks from earthquake Based on operations being performed, the FSARs estimated the MAR (e g , calculating a residence time factor which establishes when the material is a risk in the gloveboxes) With many of the operations no longer being performed or significantly reduced, most of the plutonium is stored in vaults or vault type rooms Storing material in vaults decreases the material at risk and consequences for seismic events This is because (1) material in vaults are in at least 2 containers compared to bare or uncontained material in gloveboxes, (2) the material is not distributed throughout the gloveboxes, reducing the probability of material being impacted by falling debris, and (3) the vaults have greater structural integrity than gloveboxes
6	Yes	This is determined to represent a USQ in USQD-RFP-93 1170-TLF 'Because relatively non-dispersible plutonium metals are being converted over time into dispersible plutonium compounds and the number of containers with dispersible compounds present is increasing, the quantity of plutonium that may be released from a postulated accident is increasing '

3. Could the proposed activity increase the probability of occurrence of a malfunction of equipment important to safety previously evaluated in Safety Analyses? Yes __ No ___ Explain

G V	Response	Explanation
1	No	The possible malfunction are due to corrosion of different components The solutions may corrode seals in valves and pumps used to transfer the solutions The various components have always been exposed to the plutonium solutions The five year storage has not significantly increased the rate of corrosion of these components
2	No	As evaluated in USQD-RFP-93 1170-TLF, 'The current condition of plutonium stored in various buildings at RFP generally does not affect the probability of occurrence of a malfunction of equipment important to safety '
3	Yes	The increased repair time as well as the qualitative assessment of decreased functionality of VSS increases the probability of occurrence of a malfunction of equipment important to safety
4	No	Possible increase of MAR does not impact the frequency of occurrence of malfunction of equipment important to safety
5	No	The FSARs analyzed the risks from earthquake
6	No	As evaluated in USQD-RFP-93 1170-TLF, 'The current condition of plutonium stored in various buildings at RFP generally does not affect the probability of occurrence of a malfunction of equipment important to safety '

4 Could the proposed activity increase the consequence of a malfunction of equipment important to safety previously evaluated in Safety Analyses? Yes __ No ___ Explain

G V	Response	Explanation
1	No	As explained in question # 2, the quantities of solutions available for spills have not changed since cessation of production

2	No	As evaluated in USQD-RFP-93 1170-TLF, 'The consequence of a container failure should not differ significantly from the consequence of plutonium oxide spills analyzed in the FSARs '
3	No	VSS degradation impacts overall performance, however, the consequences bins would not be exceeded Consequences of VSS malfunction have bee evaluated in FSARs and are not changed
4	No	Three USQDs have been performed, addressing this issue for Buildings 559, 707, and 771 This is currently being evaluated for Building 371 Based on new hold-up estimates only Building 771 represented a USQ condition
5	No	The FSARs analyzed the risks from earthquake
6	No	As evaluated in USQD-RFP-93 1170-TLF, 'The consequence of a container failure should not differ significantly from the consequence of plutonium oxide spills analyzed in the FSARs '

5 **Could the proposed activity create the possibility of an accident of a different type than any previously evaluated in Safety Analyses? Yes __ No ___ Explain**

G V	Response	Explanation
1	Yes	Spills have been analyzed in the SARs The tanks are vented to glovebox ventilation systems, and the Criticality Safety group review indicate that plutonium solutions have not stratified However, USQD-RFP-95 0387-CAS identified an USQ relating the accumulation of hydrogen in the tanks as an accident of a new type The referenced USQD addressed the issue for buildings that have tanks, Building 371 and 771
2	No	The issue is identical to that in USQD-RFP-93 1170-TLF 'The potential types of accidents related to the current storage of plutonium at RFP (fires and spills) are a subset of those accidents which were previously analyzed in safety analyses '
3	Yes	As presented in the above text, the current condition can lead to an accident with concurrent loss of a VSS, an accident of a new type
4	No	Possible increase of MAR does not create an accident of a different type
5	No	The FSARs analyzed the risks from earthquake
6	No	The issue is identical to that in USQD-RFP-93 1170-TLF 'The potential types of accidents related to the current storage of plutonium at RFP (fires and spills) are a subset of those accidents which were previously analyzed in safety analyses '

6 **Could the proposed activity create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in Safety Analyses?
Yes __ No ___ Explain**

G V	Response	Explanation
1	No	The three major concerns of plutonium solutions are corrosion, stratification, and radiolysis None of these presents the potential to create a new type of malfunction Corrosion of minor components is not new at RFETS and has been evaluated As mentioned above stratification is not a concern, and the tanks are vented, therefore, accumulation of the radiolytically generated gases is not expected
2	No	The issue is identical to that in USQD-RFP-93 1170-TLF 'The current condition of plutonium stored in various buildings at RFP does not create the possibility of a

		malfunction of equipment important to safety of a different type than any previously evaluated in safety analyses '
3	No	The failure modes identified in the Failure Mode Effect Analyses and Fault Trees are still applicable and no new modes have been identified
4	No	Possible increase of MAR does not create a new type of malfunction of equipment important to safety
5	No	The FSARs analyzed the risks from earthquake
6	No	The issue is identical to that in USQD-RFP-93 1170-TLF 'The current condition of plutonium stored in various buildings at RFP does not create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in safety analyses '

7 **Could the proposed activity reduce the margin of safety as defined in the basis for any TSR?**
Yes __ No ___ **Explain**

G V	Response	Explanation
1	No	The nitric acid is compatible with stainless steel Other aspect of this vulnerability do not relate to margin of safety
2	Yes	This is determined to represent a USQ in USQD-RFP-93 1170-TLF 'Since the oxidation of plutonium metal parts may change the shape or geometry credited as a contingency in many NMSLs and CSOLs, the current storage condition does reduce the margin of safety defined in the basis of the OSRs '
3	Yes	The OSR/TSRs and the accident analysis chapter in the FSARs implicitly credit maintaining the facility and equipment in a safe condition Therefore, all aspects related to the vulnerability have decreased the margin of safety as defined in the basis and assumptions of the OSR/TSRs
4	No	The FSARs accounted for MAR fluctuations and differences There is not a reduction in the margin of safety related to this vulnerability
5	No	The FSARs analyzed seismic events There is not a reduction in the margin of safety related to this vulnerability
6	Yes	This is determined to represent a USQ in USQD-RFP-93 1170-TLF 'Since the oxidation of plutonium metal parts may change the shape or geometry credited as a contingency in many NMSLs and CSOLs, the current storage condition does reduce the margin of safety defined in the basis of the OSRs '

NOTE 1 **If any of the above seven USQD questions are checked (✓) Yes, the activity is a USQ The Program Manager, NS or Director, Engineering and Safety Services is immediately notified before proceeding**

8 **Does the activity constitute a USQ? Yes ✓__ No __ Explain**

Several of the general vulnerabilities identified in the Assessment have been previously determined to represent an USQ These are general vulnerabilities 1 (as it relates to accumulation of hydrogen in tanks), 2, 4 (for hold-up material in Building 771), and 6 However, this USQD identified a new USQ condition related to general vulnerability # 3 The USQ is based on VSS degradation Several factors contributing to VSS degradation are discussed The factors are (1) increased repair time, (2) general loss of functionality, and (3) problems associated with compensatory measures Together these factors require positive responses to questions 3, 5, and 7

9 **Does the activity require a change to the TSR (or OSR)? Yes __ No ✓**

10 Could the activity result in exceeding the criticality safety acceptance criteria?
Yes ✓ No ____ Explain

As stated in USQD-RFP-93 1170-TLF, 'oxidation of plutonium metal may result in loss of shape or geometry control credited as a contingency in many Criticality Safety Operating Limits (CSOLs) and Nuclear Material Safety Limits (NMSLs) This would violate the double contingency principle which is an accepted criticality safety acceptance criterion Since at least two contingencies must fail (i e , at least two independent and unlikely events must occur) before an inadvertent nuclear criticality can occur, an inadvertent nuclear criticality is still an unlikely event '

NOTE 2 **If any of the above questions are checked (✓) Yes, DOE approval is required to proceed with the proposed activity.**

11 Does the proposed activity require an authorization-basis related FSAR change?
Yes ✓ No ___

12 Hazardous Material Evaluation:

1 Does the proposed activity introduce a new hazardous material not evaluated in a Safety Analysis?
Yes __ No ✓ Explain

There is no new hazardous material discussed in the Assessment

2. Does the activity increase the probability or consequences of an accident resulting from hazardous materials previously evaluated in Safety Analyses, or exceed any established inventory quantity limits? Yes __ No ✓ Explain.

The Assessment does not address the storage or use of hazardous materials other than those discussed (Pu, Pu alloys, and Pu compounds) in this evaluation

NOTE 3 **If Hazardous Material Evaluation has a question checked (✓) Yes, DOE notification is required to proceed with the proposed activity**

13 Are Compensatory Actions required? Yes __ No ✓

Proposed corrective actions described in the Assessment are not evaluated in this USQD These actions should be evaluated in separate SES/USQD evaluations during their planning and implementation processes The USQ conditions associated with General Vulnerability # 3 require no compensatory measures This is because accidents of these types (e g , fires concurrent with the loss of a VSS) are not risk significant These accidents are in the PC-4 category (frequencies <1e-4 per year) Seismic events generally dominate the PC-4 consequence criteria, which would involve a more MAR and similar release fraction/leak path factor The risk associated with these accidents is estimated to be approximately 8E-7 rem/yr This is based on the consequences of a fire and the frequency of PC-4 bin

Risk reduction activities (i e , thermal stabilization, liquid stabilization, and certain activities associated with HSP 31 11 noncompliance issues) should continue The reasons for this is as follows

1) For Building 707 thermal stabilization activities, the analysis performed for the thermal stabilization bounds the risk that would be involved with these additional accidents (This was part of the rebaseline effort performed in support of the

thermal stabilization ORR DOE has reviewed and approved the thermal stabilization addendum to the Building 707 rebaseline report)

2) For liquid stabilization, the Integrated Safety Assessments identified the needed safety systems and associated requirements

3) HSP 31 11 issues (non-compliant material) has previously been declared a USQ condition Certain activities (e g oxide brushing) were identified as necessary to reduce the risk associated with the condition The termination of these activities is judged to pose more risk than continuing activities which reduce the inventory of HSP 31 11 non-compliant material

It should be noted that the current procedure for performing USQDs requires comparing the risk condition(s) created by the 'proposed change' to the risk envelope defined by the Authorization Bases which includes operational accidents and natural phenomena induced events Revisions are being made to this procedure such that changes that impact operational accidents are compared to operational accident criteria, and changes impacted by natural phenomena are compared to natural phenomena criteria These revisions to the USQD procedure would not require changes to any of the USQD questions that are answered 'yes', because the conditions as evaluated in this USQD still (1) increase the probability of occurrence of a malfunction of equipment important to safety, (2) create an accident of a new type, and (3) decrease the margin of safety Also, changes to this procedure would not change the conclusion that these additional scenarios are not risk significant

Though no compensatory measures (as associated with OSR LCO out-of-tolerances) are required, there are several risk reduction programs that remedy the General Vulnerabilities of the Assessment The risk reduction programs are the *Site Integrated Stabilization Management Plan,* (SISMP) and *Implementation Plan for Recommendation 94-3, Rocky Flats Seismic and Systems Safety* (94-3 IP) 94-3 IP was developed in response to Defense Nuclear Facility Safety Board Recommendation 94-3 (94-3) In general, DNFSB 94-3 recommends that the safety issues related to consolidating Special Nuclear Material (SNM) into Building 371 be evaluated and documented, as well as identifying improvements The SISMP tasks address plutonium metal & oxides, and plutonium solutions The SISMP also addresses issues not described in the Assessment (e g , residue remediation and stabilization)

A General Vulnerability related to corrective maintenance repair times is identified in this USQD The current repair times are significantly longer than what is assumed in the FSARs This invalidates the FSAR assumption that an accident concurrent with the loss of VSS is incredible As discussed in the body of the USQD, though the condition is a USQ, accidents of this type (concurrent with loss of VSS) are not risk significant However, changes have been made to the Integrated Work Control Program (e g , reduce the number of signatures on the Work Package) that reduce the time for issuing a Work Package Also, a newly issued Basis for Interim Operation (BIO), Building 886 BIO, has the maintenance program with certain attributes as a required administrative program

Specifically, the Building 886 authorization basis states as part of its TSR's 'The Maintenance Program for the Building 886 Complex shall be maintained by the contractor to provide control of all facility corrective and preventive maintenance activities For the Building 886 complex, the Maintenance Program shall include the following attributes

- Established maintenance identification, request, planning and implementation processes
- Technical safety reviews of maintenance work packages
- Identification of preventive maintenance requirements by operations, engineering and maintenance
- An established materials management process for consumables and repair parts
- Maintenance of safety Systems, Structures, and Components '

14 USQD Conclusion

The Assessment identified several safety concerns (i e , the vulnerabilities) The Assessment also postulated several types events The above information reviewed the vulnerabilities, events and the methodology used for the Assessment The methodology used to rank the postulated events is significantly different than the risk assessment methods used in the FSARs Therefore, an USQD is not performed on the events The six general vulnerabilities are evaluated in the above determination The conclusions regarding each of the General Vulnerabilities are in Table 16

Table 16 Conclusions for each of the General Vulnerabilities

General Vulnerability	Conclusion
1	The FSARs analyzed spills in all frequency bin While nitric acid solution degrade plastic bottles and valve seals, the overall probability of spills has not increased above the values the FSARs This is attributed to the lack of production Nitric acid is compatible with stainless steel Accumulation of hydrogen in tanks due to radiolysis is declared a USQ in USQD-RFP-95 0387-CAS
2	The increased fire hazards and challenge to container integrity is previously determined to be a USQ in USQD-RFP-93 1170-TLF
3	Degradation of VSS in terms of loss of equipment/system functionality and increased system unavailability does represent a USQ condition not previously identified and evaluated Though much of the evaluation is focused on the ventilation system, as explained above, the factors effecting these conditions are prevalent for all VSS and all buildings This determination is largely based on qualitative arguments with the degree of degradation not quantified However, sufficient information is available to determine that (1) the overall loss of functionality as seen by the many compensatory measures (e g , placing automatic features in manual control and measures explicitly identified in the many shift and operation orders) and (2) the system unavailability has increased due to increased repair time presents an USQ Aspects addressing this USQ are in the question concerning compensatory measures
4	The vulnerability of increased inventory does not automatically translate into an increased MAR The FSARs allowed for fluctuation in MAR This is done by calculating a residence time factor for certain operations Several programs have evaluated hold-up material in ductwork USQDs evaluated the increase for several buildings with a positive USQ for Building 771 (USQD-771-94 1592-BJS) The current information does not support a USQ, however, as new estimates of hold-up become available this will be appropriately evaluated
5	Plutonium stored in structures that do not meet Design Basis Earthquakes does not represent a USQ because the FSARs have evaluated this condition Also, there are no conditions that would invalidate the FSARs and associated USQDs with respect to this issue
6	Items not in compliance with HSP 31 11 have been previously determined to represent a USQ in USQD-RFP-93 1170-TLF

Attachment 1

SAFETY EVALUATION CHECKLIST

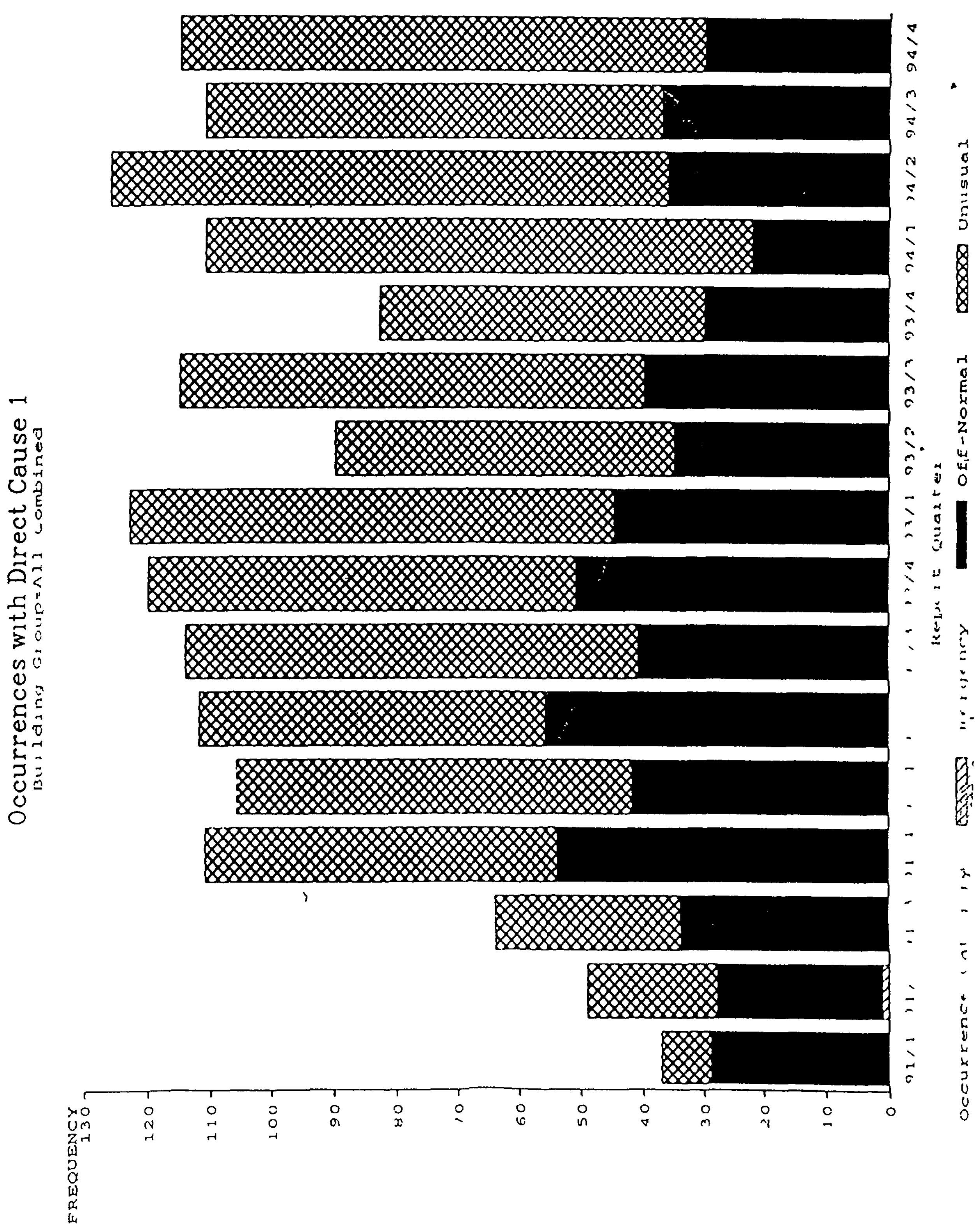
Complete Safety Evaluation Checklist and perform an evaluation to determine or describe how the proposed activity would affect the questions asked in the USQD Consider the concerns including, but not necessarily limited to the topics listed below Sentence or paragraph explanations for each question is optional

1	Containment/Configuration Integrity	Yes ✓	No ____
2	Seismic analysis	Yes ✓	No ____
3	System/Component performance	Yes ✓	No ____
4	Single failure criteria or double contingency principle	Yes ✓	No ____
5	Separation criteria	Yes ____	No ✓
6	Room/Building habitability	Yes ✓	No ____
7	Fire protection or fire loads	Yes ✓	No ____
8	Release of radioactivity	Yes ✓	No ____
9	Design bases assumptions, or value used in FSAR	Yes ✓	No ____
10	Materials compatibility	Yes ✓	No ____
11	Potential consequences of procedure errors	Yes ✓	No ____
12	Missile protection, including aircraft	Yes ✓	No ____
13	Heavy loads	Yes ____	No ✓
14	Natural phenomena such as flood, wind, lightning	Yes ✓	No ____
15	Environmental qualification	Yes ____	No ✓
16	Electrical failure	Yes ✓	No ____
17	Diesel loading	Yes ✓	No ____
18	Battery/Electrical bus loading	Yes ✓	No ____
19	Mechanical failure	Yes ✓	No ____
20	Control signal failure	Yes ✓	No ____
21	Potential for internal plant flooding	Yes ✓	No ____
22	Operational Safety Requirement/Basis	Yes ✓	No ____
23	Security	Yes ____	No ✓
24	Installation	Yes ____	No ✓
25	Explosions	Yes ✓	No ____
26	Radwaste	Yes ✓	No ____
27	Emergency Procedures	Yes ✓	No ____
28	Fissile Material movement	Yes ✓	No ____
29	Storage of Fissile Materials	Yes ✓	No ____
30	Layout/configuration of Fissile Materials	Yes ✓	No ____
31	Amount of Fissile Material present	Yes ✓	No ____
32	Criticality	Yes ✓	No ____
33	Frequency and Consequences	Yes ✓	No ____
34	Nonconformance Reports	Yes ✓	No ____
35	Other Concerns	Yes ____	No ✓

(List those considered in the Safety Evaluation, but not listed above)

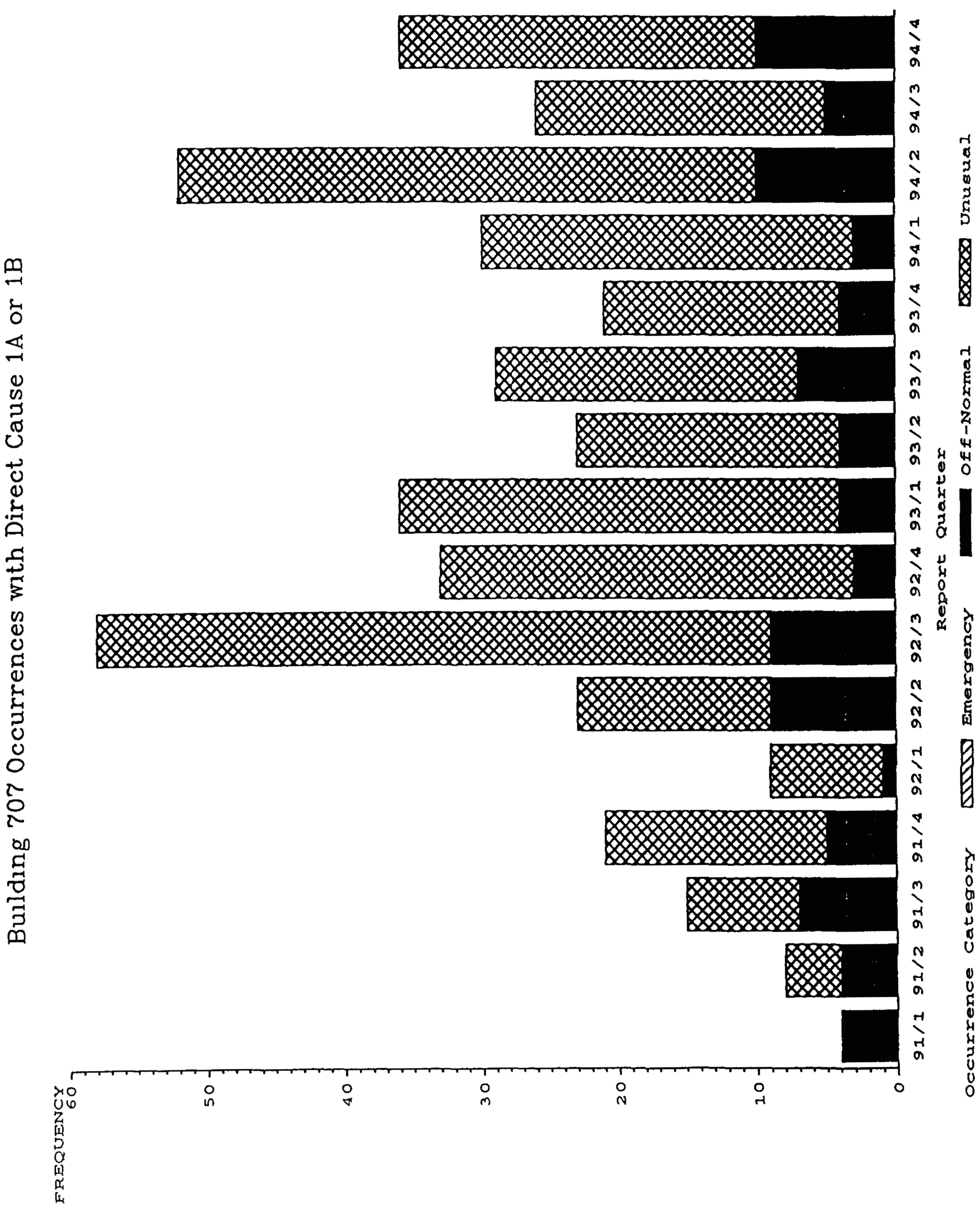
Attachment 2

Direct Cause 1 is Equipment / Material Problem



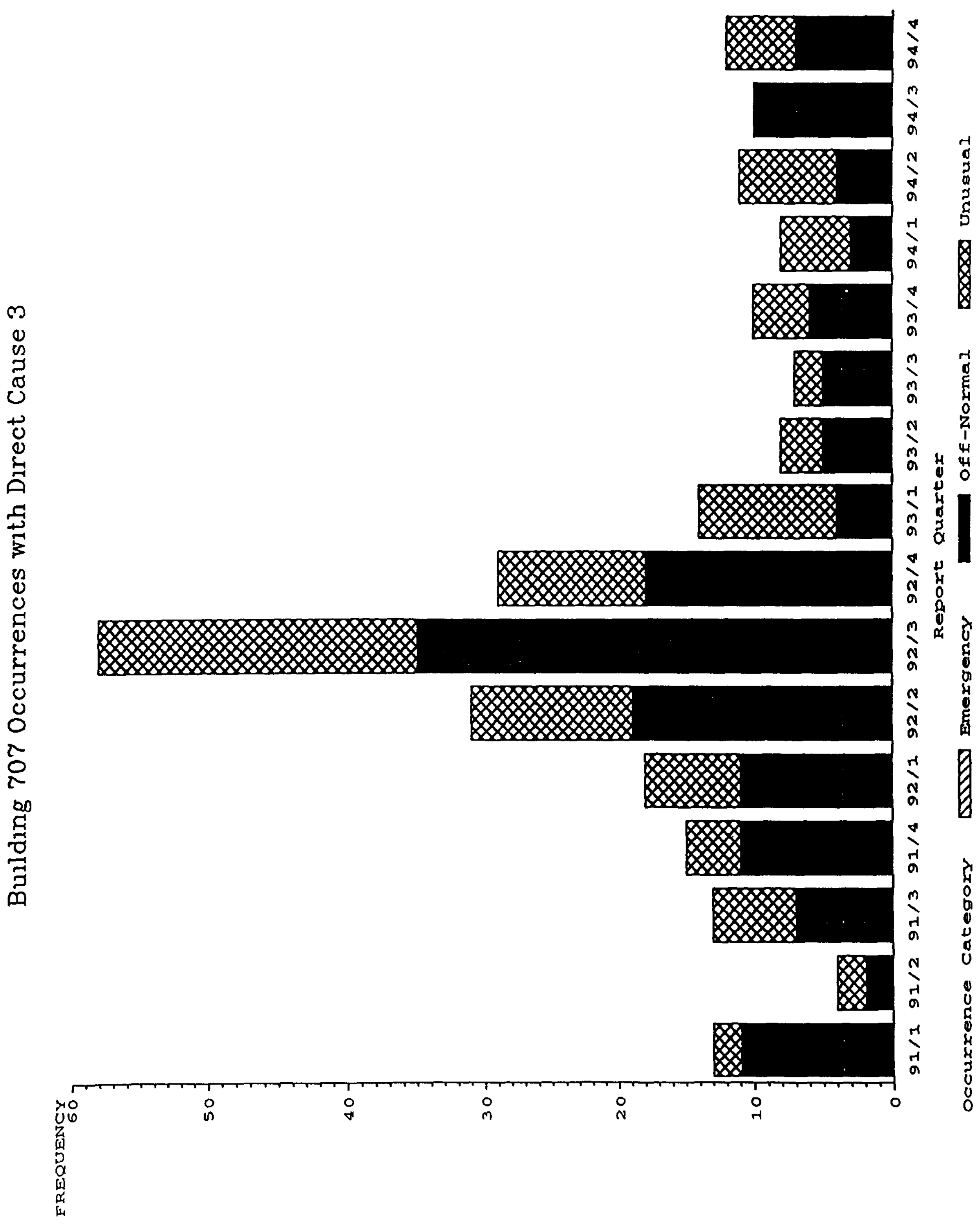
Attachment 2 continued

Direct Cause 1A is Defective or Failed Part
Direct Cause 1B is Defective or Failed Material



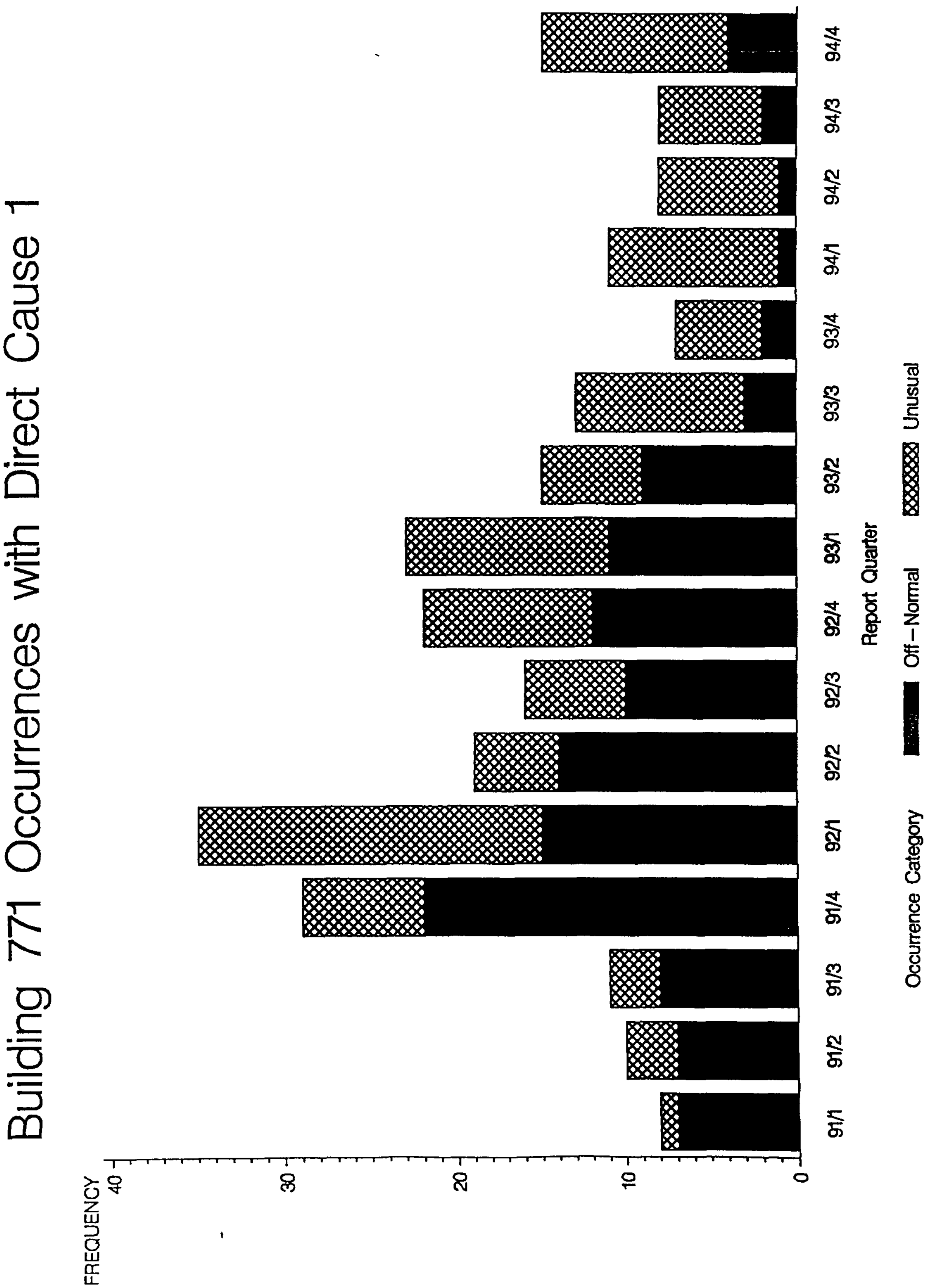
Attachment 2 continued

Direct Cause 3 is Personnel Error

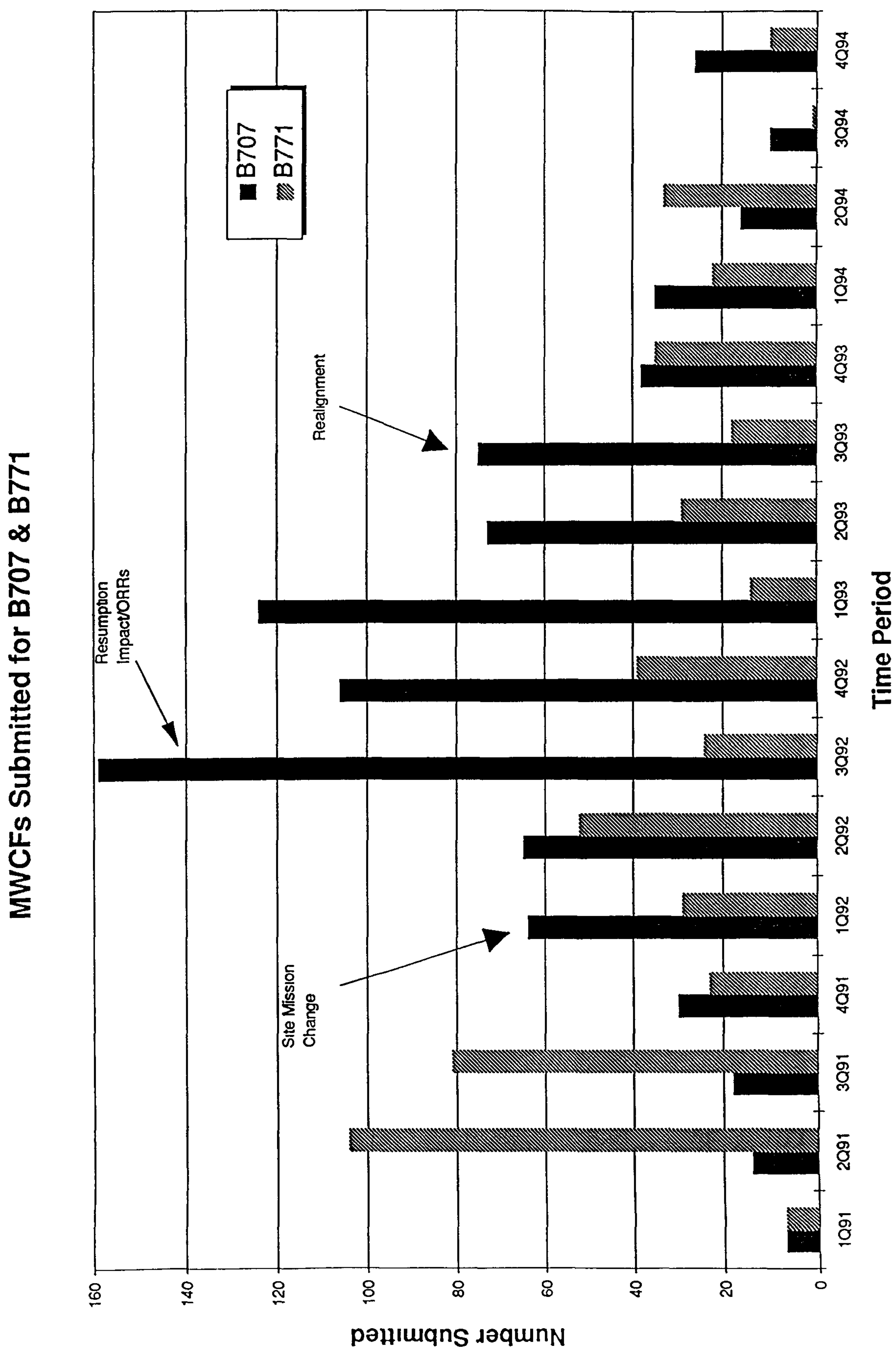


Attachment 2 continued

Direct Cause 1 is Equipment / Material Problem



Attachment 2 continued



Attachment 3

EG&G ROCKY FLATS

INTEROFFICE CORRESPONDENCE

DATE April 11, 1995

TO B W White, Nuclear Safety Analytical Support, Bldg T893A, X8261

FROM J W Keller, Systems Analysis, Bldg T893B, X8013 JWK

SUBJECT HUMAN FACTORS REVIEW OF COMPENSATORY MEASURES - JWK-003-95

PURPOSE
This purpose of this correspondence is to transmit formally the findings of the Human Factors review of compensatory measures

DISCUSSION
Attached is the report that documents the Human Factors review of compensatory measures in Building 707 The report concludes that the high number of compensatory measures currently in place in Building 707 has adversely affected the effective implementation of the compensatory measures as a whole

RESPONSE REQUIREMENTS
If you have any questions, please feel free to call me at X8013/DP5279

JWK

Attachment
As Stated

cc
K M Beggane
M M McDonald
E J Nuccio
M A Rodriguez

Attachment 3 continued

Human Factors Review of Compensatory Measures
April 11, 1995

INTRODUCTION

A compensatory measure is a human action that is used to support temporarily a Vital Safety System (VSS) that is functioning at a level less than that required by the building s Operational Safety Requirements (OSR) Individual compensatory measures are supposed to compensate for the deficiency The Plutonium ES&H Vulnerability Assessment Site Assessment Team Report questioned whether there are currently too many compensatory measures to manage effectively and if the perceived loss of experienced personnel has adversely affected the ability to implement these compensatory measures A Human Factors review of the compensatory measures in place in Building 707 was done in an attempt to answer these questions

DISCUSSION

When there is a problem with a VSS, a compensatory measure is implemented based on requirements from the OSR Personnel from the shift managers office are responsible for the management of the compensatory measure system, including documentation in shift orders, action and termination attachments, and operations orders This documentation was reviewed and the individual compensatory measures were categorized by type and VSS Determining a total number of compensatory measures is problematic because they cover a wide range of systems from individual gloveboxes to the entire building As of January, 1995, there were 12 Shift Orders 15 Action Attachments, 20 Termination Attachments and several Operations Orders for a total of more than 50 orders listing problems/issues within the building Twenty-seven (27) of these orders contain compensatory measures to support VSSs and cover over 80 different areas and individual systems Almost half of them are individual SAAMs and oxygen analyzers Of these 27 orders, 21 cover systems considered Level 1 (most important) VSS by the review team This relates to approximately 40 different areas and systems within the building

The different types of compensatory measures found in Building 707 include

- IF occurrence THEN action
  Specific Equipment Settings
- Do Not Enter
  Surveillances (fire watch and cracked glovebox windows)
  limiting specific operations to specific gloveboxes
- Conditional Operation (radio headsets)
  Terminations, Lockout/Tagouts
- Administrative Review

Some of these measures are performed on regular schedules (sometimes hourly), some are performed only during specific operations, some affect a specific area, and some are used only for specific occurrences The Shift Managers (SMs) and Shift Technical Advisers (STAs) rely on memory, the system status boards, and the written orders to manage the compensatory measures

The following are observations on individual types of compensatory measures and some of the organizations required to implement compensatory measures The observations are based on the review of the compensatory measure documentation, discussions with personnel, basic human error issues, and errors associated with specific compensatory measures as documented in the occurrence reports

Compensatory Measure Documentation and Shift Status Boards

There are over 50 different shift and operations orders that cover many different issues within the building Even with the use of the shift status boards it is difficult for the shift manager and STAs to keep track of those that are compensatory measures There have been errors in

Attachment 3 continued

which the status boards had been updated improperly causing a single point failure of a compensatory measure

Many Terminations

At any one time, there exist a large number of terminations due to SAAMs, Oxygen Analyzers, and Ventilation Issues There are too many for any one person to remember and the rate of turnover of these terminations is very high Although the system status boards are used to keep track of the large number of terminations and other issues, the high rate of compensatory measure turnover makes it very difficult to keep the status boards updated There have been a number of errors where terminations were violated due to memory errors, status board errors, or errors within the shift order itself

Overlapping Terminations

More than one termination shift order can be imposed on the same area This creates confusion when there is more than one problem in the same area and the terminations are listed separately If one of the problems is corrected, there is no system except memory to stop personnel from discontinuing the termination thinking the problem is solved There have been errors where shift orders where either left on the books and caused confusion or were removed or rewritten erroneously

If Failure Then and Stationary Operating Engineers (SOEs)

There are a number of "if-failure-then type compensatory measures assigned to second floor SOEs The second floor control room contains a copy of only the relevant shift orders that are reviewed by the SOEs on a periodic basis They also use an information board in the control room to keep track of which systems have compensatory measures The SOEs are trained using an internal qualification package that includes an apprentice program In addition there is an agreement with DOE on minimum SOE staffing requirements for 707 If the training and staffing requirements remain in place, the SOE's ability to implement compensatory measures will probably not be affected by the loss of experienced personnel

One potential problem with the SOEs system is that during off shifts they are staffed at only three (3) SOEs One SOE must always be present in the control room The second SOE will be performing surveillances around the outside of the building The third SOE will be on break which means that during off shifts there is no second floor roving SOE If a compensatory measure needs to be done, the SOE on break will be called and the compensatory measure will be performed as soon as he/she is able to re-enter the building

There is also the possibility of a single point failure of compensatory measures within the SOE program It is the shift managers job to keep the SOEs shift orders updated If the shift manager fails to update those shift orders, then the compensatory measures will certainly not get done

During emergency situations, SOEs do not always have time to review written documentation Training and experience are relied on to prioritize responses Once a safe configuration has been achieved, SOEs (per COOP) review their written documentation (including the compensatory measures) This ensures that any compensatory measures will get done eventually, but not as fast as if an automatic system had been functioning

Operations Limited to Specific Gloveboxes

There have been several instances in which material is stored in a location that is not permitted per shift orders such as on inoperable heat heads or in gloveboxes that did not contain pre-filters These errors occurred when both the shift orders and HP 31 11 issues were new and the errors have not reoccurred since late 1992

Surveillances

Although we found no recorded instances where a compensatory measure requiring surveillance of cracked windows to operate was not done, personnel have confirmed that these tasks were not done for a period of time when the compensatory measure was first

Attachment 3 continued

implemented In addition, there are many instances where other surveillance compensatory measures that are required for operation have failed (fire watch)

Recovery from Upsets

Building personnel are called upon to use their knowledge of the systems to plan and take appropriate actions to recover from upsets or during emergencies To do this, personnel must know, or be able to find out, the current status of the systems Many compensatory measures entail changes to system configurations This requires personnel to remember that changes exist in order to make correct decisions

Priorities

SMs and STAs must prioritize the actions and requirements that they are responsible for During times of stress or higher priorities the compensatory measures may be forgotten At least one failure was reported in which a compensatory measure was not implemented because personnel were involved in what was called, "a very important evolution "

Individual Compensatory Measures Under Stress

If the action needs to take place during an emergency, the likelihood of error is increased The stress level for personnel who must perform compensatory measures during a fire alarm will be greatly increased and the likelihood that they will forget to perform the action increases If they believe their lives are in danger (they can see the fire), the action will almost certainly not be accomplished

A cursory study of the compensatory measures for Buildings 371 and 771 was done as part of this review While the systems for managing compensatory measures in these building differ somewhat from that of Building 707, they seem to have the same types of problems

CONCLUSIONS

Many of the compensatory measures are put in place to augment an automatic system that is not functioning adequately This review of compensatory measures has noted several areas where humans are less reliable than the mechanical systems they are meant to support Humans are slower than mechanical systems, human reliability is lowered by stress, and other concerns may take priority over compensatory measures

It is difficult to address the issue of whether or not the ability to implement compensatory measures is being affected by the perceived loss of experienced personnel Many of the personnel who are responsible for compensatory measure, such as the shift managers, STA, and SOEs, are required to complete extensive training programs If the required training and sufficient staffing levels are sustained, then lack of experience should not adversely affect the implementation of compensatory measures

The current system for managing compensatory measures relies heavily on the memories of a small group of individuals The effectiveness of human memory decreases as the number of items that must be remembered increases Twenty-seven (27) shift orders with compensatory measures spread through a total of over fifty (50) orders are impossible to memorize effectively and searching through this much documentation can be very time consuming and error prone In addition, the high turnover rate of compensatory measures increases the probability of errors while updating the shift orders and status boards While the present system may be able to handle a small number of compensatory measures, there are currently too many for it to manage effectively

USQD COVER SHEET

USQD No USQD-RFP-94.1186-BWW	Building # 371, 559, 707, 771, 776/777, 779, 991	Page 1 of ~~43~~ 45
Title DEPARTMENT OF ENERGY, PLUTONIUM ES&H VULNERABILITY ASSESSMENT, ROCKY FLATS SITE ASSESSMENT TEAM REPORT, July 29, 1994	Job # 990002-PV	

	(Print Name)	(Sign Name)	Date
Preparer	Bruce W. White	[signature]	5/24/95
Criticality Safety Reviewer	Jerry E Hicks	Jerry Hicks	5/24/95
Certified Evaluator	Quinn R Decker	Quinn R. Decker	5/24/95
Peer Reviewer	Art R. Stithem	[signature]	5/24/95
Program Manager, Nuclear Safety	David G. Satterwhite	[signature]	5/24/95
ORC of Thomas L. Forker	H.W. HILLYARD JR SORC-95-021	[signature]	5/24/95
Responsible Manager	D. P. Snyder	D P Snyder	5/30/95
Operations Manager	R E Kell	[signature]	5/25/95

Note 1 CSR	Note 2 CEV	Note 3 Peer Reviewer	Note 4 Program Manager, Nuclear Safety	Note 5 ORC
Rev 1 JEH 1/29/96	Rev. 1 QRD 1/24/96	Rev 1 ARS 1/24/96	Rev 1 DGS 1/25/96 Rev 1 [initials] 2/5/96	Rev. 1, SORC-96-003 5/23/96 [initials]

Note 6 Responsible Manager	Note 7 Operations Manager	Note 8 Revision No.	Note 9 New Evaluation Required ☑ Yes	No
Rev 1 DP 2/6/96	[signature]	Rev. 1 1/24/96		Rev 1 ✓

Note 1 If the CSR is needed for revision, then CSR initials, otherwise CEV marks N/A and initials
Note 2 The Certified Evaluator initials for revision of USQD
Note 3 Peer Reviewer initials for revision of USQD
Note 4 Program Manger, NS initials for revision
Note 5 ORC initials for revision
Note 6 Responsible Manager initials for revision.
Note 7 Operations Manager initials for revision
Note 8 Revision of the USQD
Note 9 Check (✓) if revision significant to require reevaluation. Initials above needed to confirm only *No* determinations and a justification is required
Note 10 Changes to this USQD shall be made by a Certified Evaluator
Note 11 Mark not applicable signature blanks "N/A"

ADMIN RECORD

DOCUMENT CLASSIFICATION REVIEW WAIVER PER CLASSIFICATION OFFICE

REVIEWED FOR CLASSIFICATION/UCNI
By Jerry E. Hicks U/NU
Date 6/6/95